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VOL. LXXXVIII. JANUARY 14, 1921. No. 2,251.

ELECTRICAL REVIEW.

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THE SANE OUTLOOK.

THERE were many occasions during the war when the fact was emphatically brought home to us that it does not help one, in a difficult situation, to be depressed and look on the black side of things. A hopeful and courageous attitude of mind does not carry with it, as a corollary, the dwelling in a fool's paradise. Between the upper limit of a senseless exaltation and the lower limit of black despair, the true and only helpful mental outlook is to be reached by an understanding of the facts of the situation. The more complete the understanding, the wiser the outlook will be, until, as the French proverb says, "*tout comprendre c'est tout pardonner*," which means Omniscience.

In times of warfare the ordinary man cannot gain accurate knowledge. Vital facts are suppressed or distorted, in order that the enemy shall be misled, and so taken at a disadvantage; and it is worse than useless, in such circumstances, to endeavour to obtain knowledge which is better withheld, or to theorise vaguely without adequate—or any—foundation. But in a time of at least nominal peace it becomes the duty of every thinking individual to survey the facts, to absorb them, to get them into their right perspective, and to understand them so far as he may, and to appreciate their bearing on the course of events. In the great majority of instances it will then be found that no situation is so hopeless that it cannot mend, and no state so bad that it cannot be made infinitely worse by panicky and ill-considered action or alternatively nerveless inaction.

There is talk of a slump. What evidence is there? Lack of orders and unemployment. Since unemployment is a natural consequence of lack of business, it may be taken as an axiom that an improvement in trade will give more employment, and we are, therefore, enabled to concentrate on the question of how to secure more orders. Every man who has ever been instrumental in attempting to sell anything knows that, if quality of goods and ability to fulfil the contract satisfactorily may be presumed equal, and neglecting for the moment the factor of the salesman's personality, the determining factors in securing business are:—(1) Price, and (2) delivery. In fact, low price and quick delivery will sometimes make a buyer pass his best friend, and give the order to another maker, for goods known to be not quite equal in quality, provided the difference be not too great and obvious.

To keep up business, then, we must have low prices and quick deliveries. Low prices cannot be quoted unless the costs of manufacture are low. Short deliveries cannot be effected if goods are scarce. Low manufacturing costs are dependent, in the main, on low overhead charges; that is to say, on a high load factor in the factory. So that both considerations, price and delivery, lead us, by the shortest and straightest of paths, to the need for production, more production, and still more production. Production means cheapness, and cheapness induces demand, and demand

produces employment. Scarcity, on the other hand, or ca' canny, or restriction of output, brings about dearness, depresses demand, and produces unemployment. Thus we are led to the view that national short time is logically wrong, and can only be justified as a temporary palliative. It involves all the old fallacies about wages funds, limited amount of work to go round, and other similar heresies, the errors of which have been exposed time after time. If low production were the cure for unemployment, last year should have ended with every man fully employed. Yet we know that unemployment is worse to-day than it has been for many a long year. The advocacy of restriction of output proceeds from the same mental viewpoint that favours restriction of the population. If there are too many people, say those who hold this view, the earth cannot produce enough to support them. The truth is, that the more people there are who are willing to *work*, the better off the world is. There are plenty of people willing to draw wages, but that is not at all the same thing.

The policy of restriction of output arises partly from the fear of unemployment, and partly from the feeling that increased production produces benefits, the greater part of which are appropriated by the capitalist employer class. It ought to be more generally realised that every man who saves up a pound and buys a share with it is, to that extent, a capitalist employer. It was announced at the annual general meeting of Messrs. Dorman, Long & Co., Ltd., that 6 per cent. of the shareholders were members of the staff and workpeople, and that they held, among them, some 4 per cent. of the total capital of the company. Directors' holdings are not included in these figures. Any man who wants to secure the profits that fall to the capitalist employer ought to buy shares in the company for which he works, and so become one himself. Mr. Douglas Vickers told the general meeting of the shareholders of Messrs. Vickers, Ltd., that during the last five years the workpeople had had, in remuneration, nine times the amount that had been paid out in dividends to the shareholders. That is to say, the wages paid were only 10 per cent. less than they would have been, had no dividends at all been paid. In such a case the fear of unduly benefiting the capitalist employer is surely the merest bogey.

The fear of unemployment is more serious. Yet we think Mr. Clynes hit the nail squarely on the head when he pointed to the state of things in the cotton industry, and directly contradicted, and proved wrong, those who allege that cotton operatives are out of work because they have produced too much. They are not out of work for that reason, but because their product costs too much, and because would-be buyers have not the means wherewith to purchase cotton goods. If the output of cotton goods had been less, they would have been still more expensive, so that the capacity to purchase would have been lessened, not increased. A greater production without a corresponding increase in the cost of production would have lessened the price, and enabled the demand, which is there all the time, to have been, in engineering language, converted from potential energy into kinetic energy.

Production can be, and ought to be, increased to such an extent that each industry is able to afford to carry its own unemployment. As we have said before, unemployment will then be a direct charge on industry, to be reduced, like other direct charges, by successful direction and management.

There is need for production to-day, just as there was when the demand was so brisk that salesmanship was at a discount, and the capacity of the world for absorption of output was thought inexhaustible, together with the ability and willingness of the consumer to accept any and every kind of passed-on charge. It is necessary to-day to get actively after the business, but unless there is going to be production, selling efforts will be vain. The two things are so intimately bound up together that they cannot exist apart. Brisk demand and cheap production are mutually interdependent, and this fundamental fact must be accepted and acknowledged by employers, workers, and purchasers alike—for the purchaser has his part to play, as well as the others. Timid postponement, holding off for a fall in prices, will only damage prosperity, not increase it. What is the use of deferring the building of a power station until there is no longer a demand?

The surest way to produce a slump, and to make it a bad one, is to believe that there is going to be a slump, that it is going to be a bad one, and that nothing can avert it. As was recently pointed out in our columns, even if Europe is hopeless at present, because of the international exchange situation, there is still the British Empire; and there is still America, where the exchange operates to reduce our prices as compared with American producers.

Panic at the present time would be ruinous, and might deal the British electrical industry a blow from which it would take years to recover. The business is to be had, and it can be obtained, if only we use energetic selling methods, backed by hard work on the part of all concerned.

The Telephone "Ramp."

In the daily Press a "raging, tearing propaganda" is being carried on against what is called "The Telephone Ramp." We hold no brief for the British telephone service; years ago we foretold that if it were taken out of private hands and entrusted to a Government department, it would deteriorate in efficiency and would result in a financial loss. No prophetic powers were needed for that prediction; it was the obvious lesson of experience.

But having resolved upon the nationalisation of the telephones, the public has no right or ground for complaint at the inevitable consequences. "Serves you jolly well right" is the verdict of the unbiased observer; "you asked for trouble—now you've got it."

From another point of view also the "'Hello' Hullabaloo," as it is called by the *Globe*, is misconceived. Everyone knows that to-day's equivalent of a pre-war penny is about 2½d. The railway penny has been replaced by 1.75d.; the postage penny by 2d. On what grounds, then, should the telephone penny be left undisturbed? The annual charge is to be raised from £5 10s. or £6 10s. to £8 10s., and the charge per message from 1d. to 1½d.—an increase of practically 50 per cent. all round. The expenses have increased enormously, and the total cost per message in London to-day is 1.75d. Flat-rate or "unlimited" subscribers paying £20 for one line have been able to initiate from 5,000 to 10,000 calls a year, costing them, on the basis of the lower figure, *less than 1d. per message*. From a selfish point of view, it is not surprising that the flat-rate subscriber objects to the revision of prices!

Let us interpret the present situation by the application of cold common-sense. It simply means that at the existing rates telephone subscribers are helped to pay for their service out of the pocket of the taxpayer to the tune of £2,000,000 a year. If a subsidy to telephone users is a desirable thing and in the public interest, let it go on by all means—but let it be clearly understood by the public, and let us have no humbug about a "telephone ramp."

That the introduction of the new rates has been effected without the least regard for tact and sauvity is, of course, quite true; but it is the invariable result of nationalising a public service, which soon assumes the airs of government and turns the right to service into a grudging condescension. There is no novelty in that. Even in municipal hands, service is apt to be replaced by depotism. In 1912 we gave up the right to expect an efficient, cheap, reliable, and willing service; but some people do not seem to have awakened to the fact yet. The only hope for the improvement of the telephone service lies in denationalisation; is it even now too late to apply that remedy?

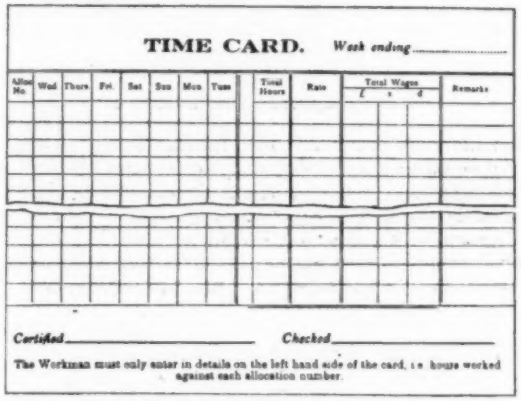
COSTING AS APPLIED TO THE ELECTRICAL INDUSTRY.

By A. CLEGG, A.C.I.S., F.C.W.A.

COSTING is a very large subject, and it is not proposed to enter into the merits or otherwise of all the different methods, but simply to give details of a system of costing adopted by a company generating and distributing electricity in this country.

In an undertaking furnishing a single product like electricity the method of single cost can be adopted, but there are generally departments dealing with the wiring of consumers' premises, laying mains, and construction of sub-stations to provide for, and we have to adopt the job system of costing for these.

The object of costing, as readers are doubtless aware, in the case of electricity, is to ascertain the cost per unit produced or sold, to reduce waste in material, time, and stores,


TIME CARD. Week ending .....

Allocation No.	Wed.	Thurs.	Fri.	Sat.	Sun.	Mon.	Tues.	Total Hours	Rate	Total Wages £	s.	d.	Remarks

Certified ..... Checked .....

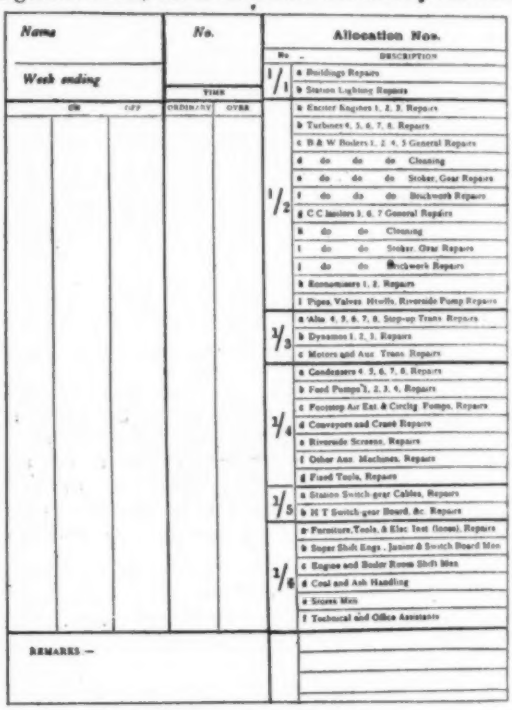
The Workman must only enter in details on the left hand side of the card, the hours worked against each allocation number.

FIG. 1.—OBVERSE OF TIME CARD.

and to supply data to the management for fixing the selling price. I think it will be agreed that the value of knowledge concerning the working costs of a modern generating station cannot be over-estimated, and that with the upward tendency of both wages and materials (especially coal, which represents 50 per cent. of the costs), it is necessary to have a comprehensive system.

There is one main point to be borne in mind in drawing up a system of costing for an electricity undertaking, and that is the form of accounts prescribed by the Board of Trade. As both municipal and company supply authorities have to comply with these requirements, it is advisable to have the main heads as a basis; further sub-divisions can be made as required, but they will all eventually have to be brought back to the Board of Trade headings in the books of account.

Generation Costs—Having dealt with costing in a general manner, we will proceed to show how the cost of generation is arrived at. The main costs represent coal, wages, water, and general stores, but as the author has already written an


Name ..... No. .....

Week ending .....

TIME: ON | OFF | ORDINARY | OVER

Allocation Nos.

No.	DESCRIPTION
1/1	a Buildings Repairs
	b Station Lighting Repairs
1/2	a Exciter Engines 1, 2, 3. Repairs
	b Turbines 4, 5, 6, 7, 8. Repairs
	c B & W Boilers 1, 2, 4, 5 General Repairs
	d do do do Cleaning
	e do do do Stoker, Gear Repairs
	f do do do Brickwork Repairs
	g C C Boilers 3, 6, 7 General Repairs
	h do do Cleaning
	i do do Stoker, Gear Repairs
	j do do Brickwork Repairs
	k Economisers 1, 2. Repairs
	l Pipes, Valves Mtrofts, Riverside Pump Repairs
1/3	a Also 4, 5, 6, 7, 8. Step-up Trans. Repairs
	b Dynamos 1, 2, 3. Repairs
	c Motors and Aux. Trans. Repairs
1/4	a Condensers 4, 5, 6, 7, 8. Repairs
	b Feed Pumps 1, 2, 3, 4. Repairs
	c Forcemp Air Ext. & Circlg. Pumps. Repairs
	d Conveyors and Crane Repairs
	e Riverside Screens. Repairs
	f Other Aux. Machines. Repairs
	g Fixed Tools. Repairs
1/5	a Station Switch gear Cables. Repairs
	b H T Switch gear Board, &c. Repairs
1/6	a Furniture, Tools, & Elec. Inst (Issue). Repairs
	b Super Shift Engs., Junior & Switch Board Men
	c Engine and Boiler Room Shift Men
	d Coal and Ash Handling
	e Stores Men
	f Technical and Office Assistants

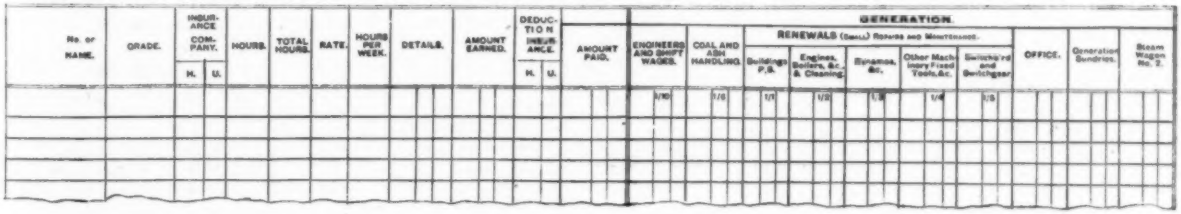
REMARKS —

FIG. 2.—REVERSE OF TIME CARD.

article on coal records,* giving details of the system of keeping them, he does not intend to deal with this item hereunder.

Wages.—There are many time-recording machines on the market, each possessing special features. The one used in the undertaking with which the author is conversant is a "Gledhill-Brook"; this type is an automatic time card recorder, and it was chosen because:—(1) it does not require an attendant to deal with time-keeping; (2) it automatically records late comers; (3) the whole of the running cost headings can be printed inside and the employé can allocate his own time. The above is an example of a time card, fig. 1, the reverse side of the card being shown in

FIG. 3.—PAY ROLL.


No. or NAME.	GRADE.	INSURANCE COMPANY. H.	U.	HOURS.	TOTAL HOURS.	RATE.	HOURS PER WEEK.	DETAILS.	AMOUNT EARNED.	DEDUCTION INSURANCE. H.	U.	AMOUNT PAID.	GENERATION. ENGINEERS AND SHIFT WAGES.	COAL AND ASH HANDLING.	RENEWALS (Small) Repairs and Maintenance. Buildings P.S.	Engines, Boilers, &c., & Cleaning.	Dynamos, &c.	Other Machinery Fixed Tools, &c.	Switchgear and Switchgear	OFFICE.	Generation Sundries.	Steam Wagon No. 2.
													1/10	1/3	1/1	1/2	1/3	1/4	1/5			

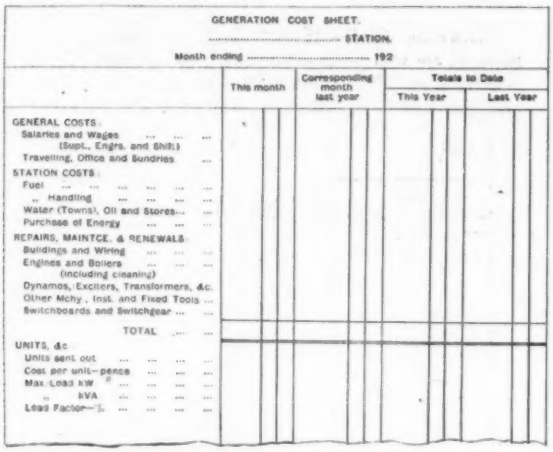
MAX. Q. .....
MIN. Q. .....

DR. RECEIVED. Date	Inv. No.	From	Quantity	Cwt.	Qrs.	Lb.	Rate	£ s. d.	CR. ISSUED. Date	Quantity	W.O. No.	Cwt.	Qrs.	Lb.	Rate	Stores sheet No.	£ s. d.

FIG. 4.—STORES LEDGER.

* ELEC. REV., October 8th, 1920, p. 455.

fig. 2. It might be mentioned that in order to prevent one employé booking on or off for another employé, the racks containing the cards and the recorder should be near the foreman's desk or stores office, where they can be under constant supervision.


GENERATION COST SHEET.

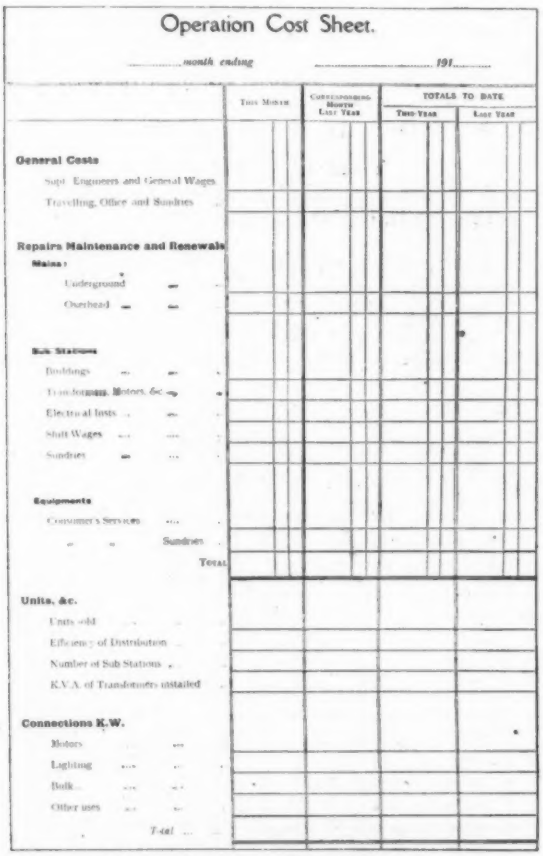
..... STATION.

Month ending 192

	This month	Corresponding month last year	Totals to Date: This Year	Totals to Date: Last Year
GENERAL COSTS:				
Salaries and Wages (Supt., Engrs. and Shift)				
Travelling, Office and Sundries				
STATION COSTS:				
Fuel				
,, Handling				
Water (Towns), Oil and Stores				
Purchase of Energy				
REPAIRS, MAINTCE. & RENEWALS:				
Buildings and Wiring				
Engines and Boilers (including cleaning)				
Dynamos, Exciters, Transformers, &c.				
Other Mchy., Inst. and Fixed Tools				
Switchboards and Switchgear				
TOTAL				
UNITS, &c:				
Units sent out				
Cost per unit—pence				
Max. Load kW				
,, kVA				
Load Factor—%				

FIG. 5.—GENERATION COST SHEET.

At the end of the week, the time cards having been checked by the foreman and initialed by the station superintendent, are forwarded to the head office, where the wages clerk using a calculating machine arrives at the amount payable to the employé. This is entered on the pay-roll, which is ruled with headings as on the time card; the allocation of the man's time is, therefore, very simple. In


Operation Cost Sheet.

.....month ending ..... 191.....

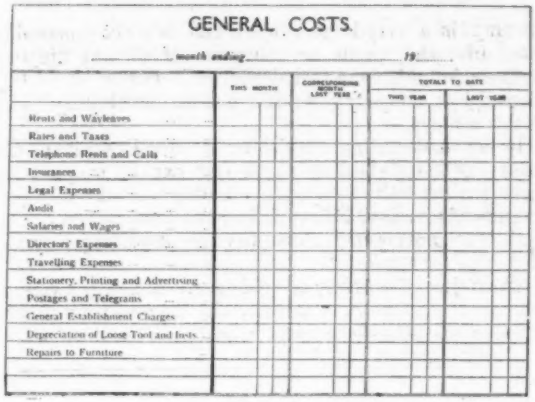
	This Month	Corresponding Month Last Year	Totals to Date: This Year	Totals to Date: Last Year
General Costs				
Supt. Engineers and General Wages				
Travelling, Office and Sundries				
Repairs Maintenance and Renewals				
Mains:				
Underground				
Overhead				
Sub Stations				
Buildings				
Transformers, Motors, &c.				
Electrical Instn.				
Shift Wages				
Sundries				
Equipments				
Consumer's Services				
,, ,, Sundries				
Total				
Units, &c.				
Units sold				
Efficiency of Distribution				
Number of Sub Stations				
K.V.A. of Transformers installed				
Connections K.W.				
Motors				
Lighting				
Bulk				
Other uses				
Total				

FIG. 6.—OPERATION COST SHEET.

the following example the headings are reduced to the Board of Trade headings, fig. 3.

Stores.—It is not intended to enter into details of how goods are dealt with when received into the stores, but it may be of interest to give a ruling of the stores ledger, from which it will be seen that provision is made for keeping "maximum" and "minimum" stocks, fig. 4.

No goods are allowed out of the stores without a requisition, which is drawn up in a very simple form; the only comment necessary is that only certain authorised persons are allowed to sign requisitions, and they must also fill in the allocation. These allocations are mainly the same


GENERAL COSTS.

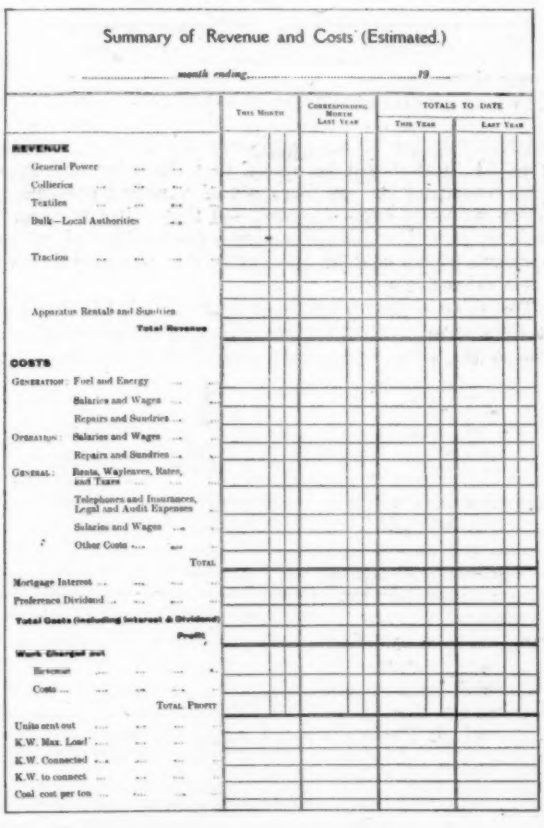
.....month ending.....19.....

	This Month	Corresponding Month Last Year	Totals to Date: This Year	Totals to Date: Last Year
Rents and Wayleaves				
Rates and Taxes				
Telephone Rents and Calls				
Insurances				
Legal Expenses				
Audit				
Salaries and Wages				
Directors' Expenses				
Travelling Expenses				
Stationery, Printing and Advertising				
Postages and Telegrams				
General Establishment Charges				
Depreciation of Loose Tool and Instr.				
Repairs to Furniture				

FIG. 7.—GENERAL COST SHEET.

as those on the wage card, with the exception of oil, rags, &c. The requisitions are priced daily by the stores ledger clerks, and entered weekly on a stores allocation sheet, which is signed by the station superintendent.

General.—We have now dealt with wages and stores, and it will be seen that the station superintendent has signed both record sheets at the end of the week, and had an opportunity


Summary of Revenue and Costs (Estimated.)

.....month ending.....19.....

	This Month	Corresponding Month Last Year	Totals to Date: This Year	Totals to Date: Last Year
REVENUE				
General Power				
Collieries				
Textiles				
Bulk—Local Authorities				
Traction				
Apparatus Rentals and Supplies				
Total Revenue				
COSTS				
GENERATION: Fuel and Energy				
Salaries and Wages				
Repairs and Sundries				
OPERATION: Salaries and Wages				
Repairs and Sundries				
GENERAL: Rents, Wayleaves, Rates, and Taxes				
Telephones and Insurances, Legal and Audit Expenses				
Salaries and Wages				
Other Costs				
TOTAL				
Mortgage Interest				
Preference Dividend				
Total Costs (including Interest & Dividend)				
Profit				
Work Charged out				
Revenue				
Costs				
TOTAL PROFIT				
Units sent out				
K.W. Max. Load				
K.W. Connected				
K.W. to connect				
Coal cost per ton				

FIG. 8.—FRONT SUMMARY SHEET.

of criticising them before they reach the cost clerk. It may have puzzled the reader to know what the numbers and letters by the side of the allocations on the time card mean; this is simply a short cut in allocating. The first one means No. 1 station, the second one means the number in the Board of Trade accounts; the staff soon learn these by heart, and it is easier to write 1/1A than "repairs

buildings," or 1/6D than "coal and ash handling." We now come to the point where the cost clerk takes hold. Each week details under the various headings are tabulated for wages, petty cash, and stores, and are brought forward on to the cost sheet below each month (fig. 5). The amounts of coal burnt and water used are estimated, and the proportion of salaries and office expenses on generation work is arrived at. The same process is gone through to arrive at the operation or distribution department's costs only, instead of time-cards, as the men are spread over a large area, weekly time-sheets are sent in; the allocations of the wages-sheets are different, of course, but follow the Board of Trade form with sub-divisions (fig. 6).

The management cost-sheet is practically all estimated; the basis of estimate is the previous half-year, plus any additions which are known to be likely to occur, such as general advance of rates, taxes, &c. (fig. 7).

commencement or during the execution of the work the quotation shall be increased by the amount of any additional cost of material or labour, and of any costs or expenses which may be occasioned by carrying out the work."

This all tends to increase the work of the cost clerk, as he must keep note of the date of quotation and order, and, if prices have changed, bring the same to the notice of the sales superintendent when sending the bill, to see if the extra can be charged.

On time and material jobs it has also been found advisable to get someone in authority to sign the time-sheet on behalf of the consumer, agreeing to the hours worked, and a space on the time-sheet provides for this. When the job is finished, the prime cost-sheets are closed and totalled, submitted to the sales superintendent for verification, and the bill is sent; the details can then be entered into the works order register, showing the amount

FIG. 9.—WORKS ORDER REGISTER.

Works Order No.	Date of Issue	Name	Description	Dept.	Order Book folio	Order No.	Quot. No.	Amount of Quot.	Estimate of Cost	% of Profit	Date of Account	D.B. folio	Amount of Account	ANALYSIS OF COST: Salaries & Wages	Stores & Invoices	Sundry Expenses	Total	Difference between Estimate and Actual Cost: Plus	Minus	% of Profit Actual	Remarks

Enquiry No. £ COST SHEET.
Estimate No.
W.O. issued to Wiring Dept. 19
Description.
Quotation No.
Acceptance Dated Name. Sheet No. W/O No.

19 ... Date	Particulars	Total £ s. d.	Petty cash	Petty cash Voucher No.	Invoice No.	Stores Fo.	WAGES: Hours	Rate	£	s.	d.	Motors, &c.	Switchgear, &c.	Cable	Tubing	Sundry Material	Lamps		Material returned: Analysis	Amount

FIG. 10.—PRIME COST SHEET.

When all the above three costs are completed, the accounts are transferred to a front summary-sheet (fig. 8).

There then remains the amount of revenue from sale of energy to be arrived at. Most of the accounts are sent out monthly and, therefore, there is very little estimating to do. Summary-sheets are entered up from the accounts rendered, and these supply information about the units sold under various classes, with the revenue therefrom. We have still to obtain the estimated interest accrued from loans and bank, rentals and sundry receipts, and profit on work done and in progress for consumers, interest payable on mortgages, preference shares, bank (if overdraft), &c.; the cost is then complete except for technical data, which can be obtained from various weekly or monthy reports from the generation and distribution departments.

Costing—Sales Wiring Department.—The system of costing adopted for this class must be "job costing." It is necessary, therefore, to have a works order book, from which a number is given before a job can be commenced (fig. 9).

The clerk in charge of this work must see that all details are in order before the number is given. For instance, if a quotation is sent and accepted, he should obtain a copy of the quotation, and the order from the consumer, and note any special terms and the estimated cost of the job. When these are all in order he can issue a works order-card bearing the number of the job to the wiring department, which then proceeds with the job, using the number on the time-sheets and material requisition notes.

A prime cost-sheet is then made out by the works order clerk, on which the whole costs of the various items are posted from wages-sheets, petty-cash vouchers, invoices, and stores issues from time to time as the job proceeds. The prime-cost sheet is in the above form (fig. 10). It will be seen that this is split up under headings; the benefit of these is specially noticeable where the quotation is net, plus a percentage of profit, because in most cases details have to be given, and the material going out at various intervals can all be brought together for rendering the account.

It has been very difficult to quote for jobs except on a net cash, plus percentage, basis, owing to the fluctuations in the prices of materials and wages, and a clause somewhat as follows, is often inserted:—

"This quotation is based on the cost of material and labour to-day, but if such cost is increased either before the

against the estimate, under the headings of wages and materials, account number, &c. Prime costs can then be filed for future reference, together with a copy of the quotation, order, works order card, &c., and the whole information can be got from the one source.

THE RATING OF ELECTRICITY SUPPLY UNDERTAKINGS.

AT a meeting of the SURVEYORS' INSTITUTION, Westminster, Mr. H. Stewart Logsdon discussed the subject of "Rating, as Affected by Recent Legislation," and referred to the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, which applies to electricity, water, and hydraulic power undertakings. He said this Act empowered the appropriate Government department to authorise local authorities carrying on statutory undertakings to increase their charges by such amount, not exceeding 50 per cent. of their statutory maximum charge, as would enable the undertaking to be carried on without loss. Charges could be increased in the case of other statutory undertakings by such amount as would enable the payment of three-quarters of the standard or maximum rate of dividend (if any) on the ordinary stocks or shares, or three-quarters of the pre-war rate of dividend, whichever was lower. The value of the properties to which the Act applied (with tramway and gas undertakings which had been specally dealt with in other Acts of Parliament) had been more directly affected by the war than any others, and where no order under the Act was in force, their rateable values being based upon the accounts, usually proved so low as to result in a large decrease in the assessments; indeed, in many cases the rateable value was reduced to a minus quantity. The chief factors which contributed to such a result were (*a*) The enormous increase in the tenant's working expenses, due mainly to the great advance in the cost of coal and all management expenses; (*b*) the larger share which was given to the hypothetical tenant as his remuneration. This was based upon a percentage of the capital which it would be necessary for him to invest to equip the undertaking adequately to enable him to work it satisfactorily. He did not think any convincing argument could be raised in support of the view that the tenant's share should not be increased, it being obvious that a tenant contemplating renting, say, an electricity undertaking, would find that the equipment constituting the tenant's property had risen enormously in cost. The consequent result of taking the usually accepted percentage upon this greatly increased capital expenditure was to give the tenant a larger proportion of the net receipts than in pre-war days. In the third place, the cost of repairs, insurance, and renewals of the landlord's part of the property also far exceeded any estimate based on pre-war prices. The balance of the net receipts (if

any), after providing for the tenant's share and the cost of the repairs, &c. (statutable deductions), provided the fund out of which the rent and rates had to be paid, unless the latter had been previously deducted among the working expenses. From this it would be seen that if the usual method of valuation was adopted in future—unless the gross receipts were substantially increased—the hypothetical tenant would obtain an increased share at the expense of the landlord. In his opinion, this was unreasonable, for the landlord's interest in the undertaking had increased in value in the same way as the tenant's, and consequently he should be entitled to a rent at least as high as before the war. This was an anomaly created by present-day conditions which could not, however, disturb the basis of assessment, namely, the rent which a tenant would give. The effect of an "order" under this Act to some extent modified this position by partially maintaining the rateable value, but his experience was, speaking generally, that the increased charges authorised had not been more than sufficient to meet the increasing cost of the working expenses, which left little, if any, of the increased receipts to affect the rateable value. The Act was of temporary duration, and in fact, would be in force for a period of two years only after the official termination of the war. If the rateable value of such undertakings was in future to be calculated on the hitherto accepted principles, and produced a satisfactory result, a permanent increase in the statutory charges must be authorised. The post-war conditions had produced many anomalies in our existing rating system, and the time had arrived when the whole subject should be taken under review, and the law and practice amended to meet the requirements of present-day and prospctive conditions. The method of valuing for rating purposes public undertakings such as electric tramways, railways, &c., which were not in existence at the time of the passing of the Acts which governed the present-day practice, led to many difficulties and unsatisfactory results. The present system of leaving the assessments in the hands of the overseers, who were not compelled to make a regular and periodic revaluation (except in the Metropolis), was very unsatisfactory. In many instances he knew of assessments in force to-day which were made very many years ago, when circumstances and values were entirely different. It would, in his view, appear to be of general advantage, and lead to equity of assessment, if it were compulsory for the authorities outside London to make a complete and periodic revaluation, similar to the quinquennial valuation in London; indeed, there did not seem to be any valid reason why the two parts of the country should be differently treated. Any revision of the rating system would be incomplete which did not provide for a uniform method of dealing with machinery in valuing rateable hereditaments which in some parts of England was taken into account in estimating rateable value and in others absolutely ignored.

THE PHYSICAL SOCIETY'S EXHIBITION.

THE eleventh annual exhibition of electrical, optical, and other physical apparatus held under the auspices of the Physical Society of London and the Optical Society was opened at the Imperial College of Science and Technology, South Kensington, on the 5th inst., and remained open for two days. The attendance of visitors was on the whole good, and much interest was shown in the various exhibits, some of which were, of course, not new, but others have been much improved in recent years. The exhibition is always looked forward to eagerly, inasmuch as it affords an opportunity of studying the development that has been made in scientific instruments by the leading British manufacturers.

Some 50 firms exhibited apparatus, and features that were specially appreciated were the numerous experimental demonstrations that were given of the apparatus exhibited and the lectures that were delivered; for instance, Sir W. H. Bragg, K.B.E., F.R.S., discoursed on "Sounds in Nature," and Prof. C. R. Darling on "Some Unusual Surface Tension Phenomena." Prof. C. L. Fortescue and Dr. Bryan demonstrated some uses of a thermionic valve, explaining a number of well-known circuit arrangements, all the parts of which were exposed to view. The apparatus was shown connected up for illustrating the effects of "space charge" and "saturation," and for determining quickly the characteristics of the valves. The use of the valve as both an audible and high-frequency generator was demonstrated, as well as the "heterodyne" method of receiving continuous-wave signals, and certain other interesting phenomena of "beats."

Messrs. R. W. Paul and F. Twyman demonstrated, by interferometry, the distribution of temperature around a hot body. The variation of the refractive index in gases being linear with increase of temperature, if a hot body be placed in an interferometer of the Hilger type, various bands are formed around the body which are isotherms. The convection currents in air, from electrically-heated wires, were shown both with and without baffles. The method of investigation was suggested by Mr. Cuild.

Emeritus Professor Archibald Barr, D.Sc., LL.D., was to have lectured on the optophone, an instrument which enables the totally blind to read ordinary print. Owing, however, to indisposition he was unable to do so, but Mr. F. Morrison, his deputy, performed his task admirably.

Following the lecture, Miss Mary Jameson, who has been blind from birth, convincingly demonstrated the possibilities of the instrument. She read with accuracy, although she had only been using the optophone for about five weeks, lines that had been selected at random from a book, proving that the results which may be obtained by the use of the device are beyond dispute. Several medical men and eye specialists, who have followed the development of the instrument, hold the same opinion. For the moment (we hope to furnish technical details at a later date) it will suffice to record the main principle of the optophone as follows: A beam of light is made to traverse a line of printed matter, and is reflected therefrom on to a selenium cell. The amount of light which reaches the cell naturally varies according to whether it is reflected from the black type or white background of the printed page, and this variation in turn changes the resistance of the selenium cell, allowing a larger or smaller current of electricity as the case may be to flow through it and actuate a pair of telephone receivers worn by the operator. The sound heard in the telephone receivers by the user is in the form of a musical note, and with practice the *motif* of different letters, and indeed of complete words, can be easily differentiated. Dr. E. E. Fournier d'Albe was the inventor of the instrument.

THE HEWITTIC ELECTRIC CO., LTD. (formerly the Westinghouse Cooper-Hewitt Co., Ltd.), had a "brilliant" display of applications of the mercury vapour arc. A small rectifier converting single-phase a.c. at 110 volts into d.c. at 120 volts was employed to supply energy to a spherical medical lamp outfit for the treatment of skin diseases, wounds, &c., by ultra-violet light. The efficiency and convenience of this method of rectifying alternating current was amply demonstrated, a notable feature being the silent operation of the apparatus. The rectifying bulb is fixed at the back of the control panel, and the starting resistance and other accessories are grouped with it. The bulb being in the operating circuit, it is essential that it should always be delivering energy if the arc is to be maintained. If the demand is an intermittent one as, for example, in a spark coil, a shunt of sufficient value must be connected in circuit. A shunt is also necessary to start the bulb against a counter e.m.f. as in battery charging. Immediately the bulb is in operation the shunt is cut out automatically or by hand. A practically constant output efficiency of 85 per cent. is obtained at 220 volts from one-quarter to full load. A special type of rectifier has been introduced by the company for the requirements of kinemas. This automatically comes into operation when the carbons of the projecting arc are brought into contact. Another device exhibited by the firm was a stationary type tracing printing machine in which two powerful mercury lamps about 5 ft. in length supply the light, the cylinder of the machine being of lead glass to prevent injury to the eyes of the operator. Other exhibits were photographic lamps for use in kinematograph studios and enlarging outfits.

MESSRS. H. TINSLEY & CO. exhibited a very varied collection of instruments, including an artificial track-circuit in operation; a self and mutual inductance standard constructed according to principles laid down by the United States Bureau of Standards; Tinsley's vernier potentiometer, described in our issue of October 1st, 1920 (p. 427); and a thermo-electric compensating potentiometer, the first of its type to be made in this country, which instrument has a range of from 1 to 10,000 microvolts; a current regulator for use with the last-named instrument; tuning fork stroboscope, an instrument which measures speeds by means of a rotating disk and a constant periodic charge through a neon tube, which discharge

is obtained through an induction coil whose primary is excited by the current passing through a contact on the tuning fork; a double Kelvin bridge with standards; an automatic wireless transmitter for aeroplanes, which we have already described, in which a commutator with a series of Morse signals is driven by clockwork in such a manner that any particular message is transmitted by moving a lever; and a number of Wheatstone bridges, &c.

Mr. F. HARRISON GLEW demonstrated radio-activity, and showed his radium applicators which are prepared with special composition; the latter is claimed to be unalterable by radium and, therefore, does not need to be re-made like ordinary varnish applicators.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., had on view the No. 11a marine direction finder which embodies the new "sense" device. Formerly the direction finder gave the bearing of a transmitting station only, *i.e.*, it did not show whether that bearing of the observed station was, say, "aft" or "forward" of the vessel taking the observation. The new "sense" device gives this information with certainty, the result being achieved by superimposing an open aerial upon the ordinary direction-finding aerial. The two minimum points on the scale are first ascertained in the usual manner, after which the open aerial is superimposed (with the addition of a resistance in the circuit to overcome the "wiping out" effect) which makes it possible to determine which of the two bearings given is the true one. The four-electrode valve amplifying detector was specially designed for use on board ship where the cost of installation and maintenance must be reduced to a minimum. The chief feature is the employment of a single valve of a new type, having four electrodes and performing the function of three separate valves, viz., high frequency amplification, rectification and low frequency or note magnification.

THE EDISON SWAN ELECTRIC CO., LTD., exhibited a number of its "Pointolite" lamps, which were fully described in our issue of January 2nd, 1920 (p. 9). These have been developed in both directions there now being sizes of 30 c.p. and 4,000 c.p. The 30-c.p. size (fig. 1) which is produced at a very low cost, takes a current of .45 amp., and has been brought forward principally for employment with reflecting galvanometers. The 4,000-c.p. size has been designed principally for kinema projection work, giving out a very long and cool high-power beam. In the pyrometric type exhibited, the temperature of the positive electrode may be varied between 1,200 and 2,800 deg. C. The standard pattern of resistance employed with these lamps is capable of being used on all d.c. voltages from 100 to 250. A two-pin plug is used in connection with several pairs of holes to obtain the correct resistance corresponding to the voltage employed which is indicated on a scale. Fig. 2 shows a 100-c.p. lamp connected through a standard resistance.

FIG. 1.—30 C.P. "POINTOLITE" LAMP.

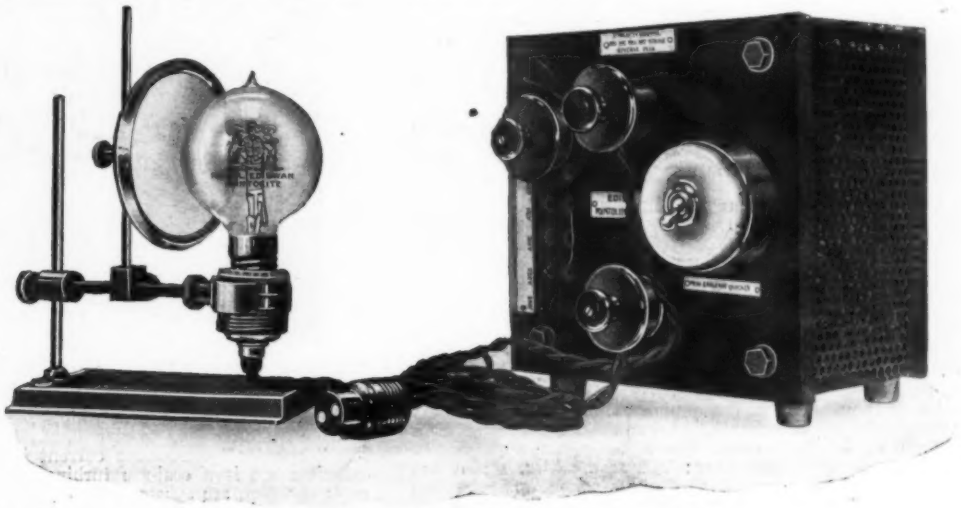


FIG. 2.—100 C.P. "POINTOLITE" LAMP AND STANDARD RESISTANCE.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., displayed a number of examples of high-pressure and X-ray apparatus. A sphere-gap voltmeter graduated in kilovolts and centimetres was shown. This instrument is provided with accurately constructed spheres of 10 cm. diameter, and is useful in connection with h.p. transformers and induction coils for radiology. The "Sonic" bedside X-rays outfit was exhibited. This is a very compact set consisting of a static oil-immersed transformer operating from an ordinary a.c. supply. A Coolidge self-rectifying radiator tube is employed which obviates the necessity of providing a rotating rectifying device. A tapping is made on the secondary winding of the transformer for the heating circuit of the tube. The whole outfit is complete in one unit, and mounted on a small cabinet, on castor wheels, which contains the transformer. The energy is switched on and off by means of a foot switch or a pear switch. Another exhibit was a boiling X-ray tube for deep therapy treatment, that is, treatment with hard radiations. A "Sunic" X-ray group with kenetron valve and a heavy-discharge type induction coil with a "Dreadnought" mercury interrupter was also shown. In addition to these there appeared a diathermy apparatus for raising the internal temperature of the human body. Two types of electrodes were shown, those for penetration and others for surgical treatment.

Mr. J. ST. V. PLETTS exhibited the new Davis-Pletts slide rule, of which he is the patentee; it is manufactured by Messrs. John Davis & Son (Derby), Ltd., and presents some remarkable features. For one thing, it is entirely British made—and reflects credit on the makers. Its chief recommendation, however, is its greatly extended scope of application, which should render it especially useful to electrical engineers dealing with telephonic and wireless telegraphic formulæ, long overhead transmission lines, and other subjects involving the use of exponential or hyperbolic functions. The log-log scale, and its reciprocal scale, are placed respectively along the upper and lower edges of the face of the rule, and are related to the upper log scale in such a way that the numbers on the latter are the common logarithms of the numbers opposite them on the former; by this means the non-recurring log-log scales can be indefinitely extended. Further, scales are provided on the slide for all the ordinary exponential, circular, and hyperbolic functions, arranged to read on the same log scale, so that the product or ratio of any such functions can be obtained. All such compound functions as $e^x \sin a$ and $\log a \cosh x$ can be obtained with a single setting of the slide and cursor, and every combination of the various functions is obtainable with two or more settings. The numerous scales have been ingeniously packed into the available space, and the scope of the new rule is astonishing; it should greatly shorten a class of calculations which are very tedious, and liable to error, when made by the usual methods.

MESSRS. EVERSHED & VIGNOLES, LTD., had an extensive show of measuring instruments of many types, including a number of their well-known "Megger" testing sets of different patterns, voltmeters, ammeters, &c. A "Dionic" water tester was exhibited. This is an improved form of the well-known apparatus for detecting and measuring traces of impurity in water so minute as to escape chemical analysis.

The complete apparatus is shown in fig. 3, where G is a glass tube to contain the water under test, and A and B are the electrodes connected to a direct-reading conductivity meter M, and a continuous-current hand-driven dynamo E. The thermometer T measures the temperature of the water under test, and is capable of being lowered or raised in the water, so altering the effective cross area of the liquid path. This thermometer is supported in a sliding holder L which moves in guides H H, and which carries an index I ranging over a scale J calibrated in degrees Centigrade. After the water to be tested has been poured into the funnel F has filled the tube G, the reading on the thermometer is noted, and its sliding holder is moved until the reading of the index I on the scale J corresponds with the thermometer reading. This operation compensates for the change of conductivity due to temperature, and the reading given on the dial of the meter M is the conductivity of the water at 20 deg. C. By turning the handle W of the dynamo, a current is generated which traverses the meter and the water in the conductivity tube G. The pointer of the meter is deflected, and comes to rest at some point upon the scale which directly indicates the conductivity of the water in the tube corrected to 20 deg. C. The test is completed as

soon as the pointer has come to rest, that is to say, in two or three seconds.

The conductivity meter measures directly, and without calculation, the conductivity of any electrolytic solution in the tube to which it may be connected. The indication is given by an index which ranges over an engraved scale, graduated in units of conductivity. The unit is the reciprocal of one megohm. In the conductivity meter for dilute solutions the scale extends from zero up to 2,000 units.

The tube is so constructed that by pouring water into the funnel F, and allowing it to overflow through the outlet pipe O, every part of the tube is thoroughly washed out. A drain pipe D of pure rubber is provided at the bottom for the purpose of drawing off the contents at the conclusion of a test.

Among the uses to which this apparatus may be put are the testing for leakage of cooling water into a surface condenser; boiler priming; measurement of "hardness" of water; ascertaining the correct proportion of quicklime to be added in "softening" water; testing water supplies or river water, &c.

Needham's "Pulsator" system of speed control was demonstrated by means of a small motor and sliding resistance representing the engines of a boat. The apparatus is designed to accurately measure and control the speed of engines by an absolutely new method. The system depends for the constancy of its indications upon an electrical condenser and a non-inductive resistance. Its action is analogous to the operation of a Wheatstone bridge, giving a wide range and great accuracy. The essential instruments of the system comprise a rheostat serving either as a speed transmitter or meter, or both; a "Pulsator" driven by the engine whose speed is to be measured or controlled; and balance indicators showing when the "Pulsator" is revolving at a speed corresponding to the position of a contactor on the rheostat. The speed transmitter in the case of a ship is mounted on the bridge with one of the balance indicators immediately adjacent. The other

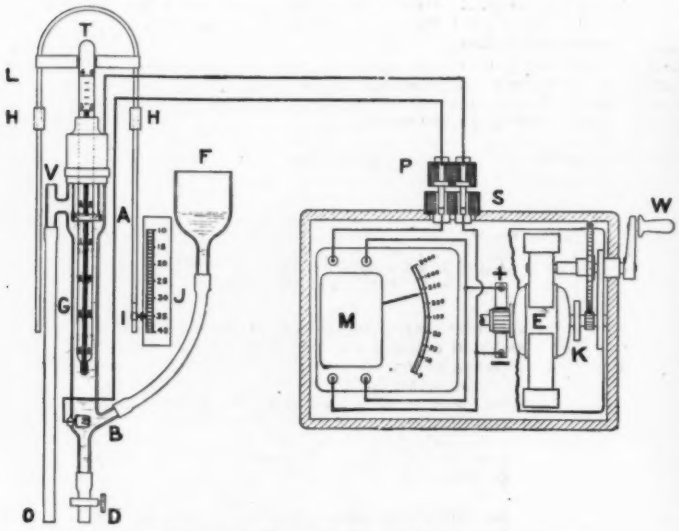


Fig. 3.—"Dionic" Water Tester. Showing Automatic Compensation for Temperature.

indicator is mounted in the engine room. The instruments are connected up by suitable wires, and can be operated from an ordinary lighting circuit. The action of the apparatus in speed-controlling is as follows: The transmitter, which has a dial graduated in revolutions per minute, is set to the desired speed, and the pointers of both indicators will then deflect to indicate either "reduce" or "increase," depending upon the nature of the change being effected. The engineer will then adjust the speed gradually until the pointer of his indicator comes to rest at "Steady," showing that the signalled speed has been attained. The bridge indicator reaches its "steady" position simultaneously. In measuring speed the dial of the meter is moved until the indicator registers "steady," when the reading in r.p.m. can be taken.

The high-pressure d.c. motor-generator set exhibited by the firm at last year's exhibition has been considerably improved. As noted in our issue of January 16th, 1920 (p. 89), the set was then designed to give an output of 15 mA at 5,000 volts by means of three small magneto-generators in series on one side of the motor. The number of generators has now been increased to six, three on each side of the motor, and the same current output is obtained, but at a pressure of 12,000 volts. The design of the generator is such that the terminal e.m.f. is practically free from ripple. The firm demonstrated the apparatus with a cathode ray tube to show some of the possibilities of the cathode ray method of investigating rapid changes of current.

The Marconi-Osram Valve Co., Ltd., showed a selection of various types and sizes of transforming, receiving, amplifying, and rectifying valves.

(To be continued.)

AN ELECTRO-MEDICAL EXHIBITION.

In response to an invitation from The Edison Swan Electric Co., Ltd., we visited a few days ago the showroom extension recently opened at 123, Queen Victoria Street, E.C. 4, for the display of electro-medical apparatus.

The production of X-ray apparatus by this firm is a recent innovation, but its efficiency and general appearance make it apparent that "Ediswan" radiographic outfits will soon be well known. The exhibit inspected was a complete unit for an operating table measuring about 7 ft. by 3 ft. The table itself is well constructed, the upper part being of three-ply wood combining elasticity with strength. The X-ray tube carriage is fitted with ball bearings, and is easily moved to any position beneath the table. A useful device embodied in the carriage is a "periscope." The side of the tube container has a lead glass window through which the image of the tube is reflected on to a mirror fixed to the inside of a shutter in the side of the carriage. This facilitates inspection with no risk of injury from the rays. The induction coil employed is the "jointless section" heavy-discharge type wound to give as little reverse current as possible. The insulation is principally paper, instead of wax, making the coil suitable for use in hot climates. Each section of the coil is one wire thick, the wire being wound on paper disks in opposite directions for each alternate disk. A special coil for low-voltage work is also manufactured by the firm, primarily to meet the requirements of medical men who do not possess an electricity supply. This may be used in conjunction with "Ediswan-Acme" large capacity accumulators, which are made up in 12-volt units, each mounted in a wooden container, highly finished, and fitted with a carrying strap. These are supplied in two capacities, viz., 44 amp.-hour and 66 amp.-hour. The coil is fitted with a high-speed hammer break, and is made in three sizes to give 10-in., 12-in., or 14-in. sparks. The "Premier" continuous current interrupter fitted in the exhibited set is a coal-gas turbine interrupter, the internal parts of which are substantially built of cast iron. This type is not affected by mercury and does not burn. The only attention required is the replenishment of the mercury at two- or three-month intervals, and the oiling of the motor and main spindle bearings. The mechanical rectifier in use with this interrupter is based on the type patented by Mr. Leslie Miller, A.M.I.E.E. In this rectifier the reverse of the induction coil, due to the "make" of the primary circuit, is stopped by a revolving disk of insulating material. The periphery of this disk is perforated at the correct intervals, allowing only the useful current to pass to the X-ray tube. Mica disks were originally used, but owing to the difficulty experienced in obtaining large disks of this material "paxolin" is now employed, and has proved an efficient substitute. The interrupter and rectifier are enclosed in a sound-proof cupboard, as shown in fig. 1. Another type of interrupter produced by the firm consists of a pear-shaped steel bowl mounted vertically above a small motor, to the armature of which it is attached. Inside the bowl is placed a small quantity of mercury which, by centrifugal force, travels up the side until it reaches the greatest diameter where it is received by a groove, and forms a complete rotating ring inside the bowl. On a vertical spindle in the inside of the bowl a fibre wheel revolving on ball bearings is fitted, slightly out of centre, so that its edge engages with the mercury ring and is rotated by it. A copper segment is fitted across the fibre wheel which cuts in at intervals, allowing a momentary current to pass. The

Fig. 1.—"Premier" Interrupter with Mechanical Rectifier.

rapidity of interruptions approximates to that of the electrolytic interrupter, and is obtained without gearing and with the motor running at its normal speed. Ten thousand interruptions per minute are obtainable with this device. The dielectric used is paraffin oil which is separated from the mercury by centrifugal action. On the "Premier" a.c. interrupter a synchronous motor is fitted; electrolytic interrupters are also included among the products of the company. The switchboard used in conjunction with the apparatus may be either of the wall or trolley patterns. The wall type is shown in fig. 2. This is a highly finished, black-enamelled board behind which the necessary resistances are fitted. These resistances are wound on hollow insulating tubes, which allow a rapid dissipation of heat and prevent the spirals sagging if overheated. The ammeter is graduated from zero to 12 mA, and by means of the multiple contact switch the current passing through the tube can be gradually increased from less than 1 mA to the maximum capacity of the coil. The centre of the board is occupied by a fine-wire resistance with a sliding contact giving a fine speed adjustment for the motor of the interrupter. Separate tumbler switches are provided for a pilot lamp, the motor, and the coil. For the last a pedal switch with a quick breaking action is provided in addition. The trolley pattern switchboard is similar in design, but is also fitted with a special quick-break double-pole switch. The board is mounted on a strong trolley fitted with rubber-tired castors. The "Ediswan" X-ray tube stand is a highly finished piece of work with adjustments for height and lateral and vertical angles. The tube container is of lead-lined wood with a lead glass inspection window.

Fig. 2.—X-ray Switchboard.

In addition to the X-ray apparatus the showroom contains a wide range of other electro-medical devices. One of these is the radiant heat bath, in which are fitted six carbon filament lamps. The case is of heat-insulated wood, and is so constructed as to fit many parts of the human body. The heat given out is stated to be very effective in cases of rheumatism, &c. Small baths mounted on insulated stands, fitted with electrodes on each side are shown. Many portable galvanic and faradic batteries are included in the display. The "Universal" earth-free machine is a set devised to meet a number of electro-medical requirements. The current is supplied by a small double-wound motor driven from an ordinary lighting circuit. The machine can be connected up in different ways to supply galvanic or faradic currents, to operate a small inspection lamp, or to provide the heating current to a cautery needle. By means of an eccentric and plunger fitted to the motor shaft, an interrupted current can be supplied, through a water resistance, to cause alternate contraction and expansion of the muscles. The motor may also be used to drive a vibrator for massage treatment through a flexible shaft. Very effective results may be obtained with the company's portable high-frequency sets, which are marvels of compactness. These are constructed for connection to a lighting circuit, they weigh only 10 lb. each, and measure 10¾ in. by 7¼ in. by 9¼ in. The accessories comprise a handle, surface electrode, rake electrode (for treatment of the hair), and a saturator (which, it is claimed, banishes insomnia).

Although not strictly electro-medical, the Ediswan "Saloon" hair dryer is worthy of mention. This consists of a small motor and fan, with a heating element (400 watts) which may either be fitted to the air nozzle or in the end of an aluminium flexible tube. The whole of the machine is light enough for application by hand, but a heavy metal base is also supplied.

Our readers, who are already acquainted with the multifarious activities of the Edison-Swan Co., will find it worth their while to visit the showrooms to view this very excellent exhibition of the company's developments in a new field.

ELECTRICITY AND AGRICULTURE.

The tenth report of the Development Commissioners for the year ended March 31st last has been published recently by H.M. Stationery Office (price 2s. net). This is a voluminous publication dealing with a wide field of research and practice in the realms of agriculture, stock breeding, rural transport, harbour improvements, fisheries, &c. Electricity has played but a small part in the work of the Commissioners, but one or two points of interest to electrical people are recorded. Dealing with transport in rural districts, the report states that this function has now been transferred to the Ministry of Transport, but the Commissioners express regret that while these questions remained within their reference they were unable to recommend the Treasury to approve more than a small fraction of the applications submitted to them. This was not owing to intrinsic defects in the schemes, most of which were for making or extending light railways, but to the stipulation in the Development Act which forbade advances from the fund to an association of persons or a company trading for profit. As no alternative agencies offered themselves, or could be found for undertaking the development of rural transport, the Commissioners found themselves powerless to make recommendations to the Treasury. The one exception—that of the Brandsby Light Railway—was a case where the promoters, the local landowners, were prepared to agree to conditions which satisfied the Law Officers of the Crown that no profits could possibly accrue to any one—a criterion that not unnaturally failed to recommend itself to the other applicants with whom the Commissioners negotiated over a period of years.

It is interesting to note that experiments in electro-culture, carried out by the Commissioners, have met with success, although previously it was thought that the benefits of electricity in this direction were, at the best, doubtful. The effects of high-pressure electrical discharges upon the growth of crops were tested in the following manner: Wires were stretched above the crop and charged to a potential of about 50,000 volts, with the result that a small current passed through the air to the crop below. The most striking point about the majority of earlier experiments of this nature is the neglect of measurements of the current used, and on this account one electro-culture experiment could not be compared with another, and there was no certainty whether too much or too little discharge had been allowed to take place. To test the action of the current and to fill this serious gap there were started a series of plot experiments in different parts of the country, a series of pot experiments, and also laboratory experiments with single seedlings. In all these experiments careful measurements were made of the current supplied, and special experiments were directed to the determination of the maximum and minimum current which could be used. The plot and pot experiments have now been continued for a number of years, and converging evidence from the field and from the laboratory indicates very clearly that by such treatment the growth of a cereal crop can be markedly increased. Differences as high as 50 per cent., 38 per cent., and 35 per cent. in favour of the electrified areas have been observed in a number of cases. It has further been shown that the plants are sensitive to a very small current, so it is easy to give a discharge which reduces, instead of increasing, growth. The amount of electric energy supplied to the individual plant is exceedingly small, for the total energy supplied *per acre* is only as much as that required for a 50 candle-power lamp. If the cost of the installation required to produce and distribute electricity in actual agricultural practice can be kept low, a new method is available for increasing the yield of crops.

The report makes reference to schemes for supplying electric power to farms, citing as an exemplary scheme the Hereford Corporation's wide activities in this direction, referred to in previous numbers of the Electrical Review. Mention is made of a grant to the Chester Corporation for a survey of the water power of the river Dee, the result of which was very promising.

French Lamp Exports.—According to statistics published in the *Bulletin* of the French Chamber of Commerce in Turin, France exported to Italy during the period from January 1st to March 31st, 1920, 1,731,000 glow lamps, worth 605,850 lire. For the year these figures would represent, roughly, 6,924,000 lamps, valued at 2,423,000 fr.

THE PROPOSED ENGINEERS' CLUB.

AN earnest endeavour is being made to found an Engineers' Club in London. The idea is a very excellent one, and it ought to be carried out on the broadest possible lines. The term "Engineer" should be made elastic, and should include those who, in the words of the charter of the Institution of Civil Engineers, turn the great forces of nature to the use and convenience of man. A club catering more or less for engineers has been tried on one or two occasions, and has not matured satisfactorily; what should be attempted now is an Engineers' Club in the widest sense, domiciled in London, with a membership obtained not from London alone, but from the provinces and our overseas Dominions.

The provision of a common ground, free from all political bias, where engineering thought can find a congenial atmosphere, must be of inestimable value to the development of a profession and industry on which largely depend the safety and well-being of our Empire. If we want to listen to a paper on "Taxation in the year 2021," or on "The propelling machinery of Noah's Ark in B.C. 5000," why should there not be a common meeting-place where we could dine in comfort before the debate, and wipe away all asperities when it was over in a sociable smoke and drink together?

Nothing can help engineering—the one great constructive force to-day, as it was yesterday and will be for all time—more than a gathering together of its vital component parts on the lines indicated above. Such a club, where members from the provinces and overseas could find a home, would provide the means.

It is impossible to look upon the financial aspect of such a venture with pre-war eyes. A subscription which might have been ample six years ago, owing to enhanced values, must now be more than doubled. An Engineers' Club in London should not be started with less than 1,000 original members, at an annual subscription of, say, ten guineas.

The scheme for the financing of an enterprise of this kind must receive close attention at a later date, and due regard must, of course, be paid to favourable terms for provincial and overseas members. The difficulties are fully realised, but are believed to be not insurmountable. To make the Club a success it must be run as a *club*, and not as a glorified saloon bar. The latter course has been adopted by certain clubs in London to-day.

The Club should aim at giving the best service possible at the lowest cost. It should be a club established for the benefit and advantage of its members, run on co-operative lines, and not a camouflaged hotel worked for the sake of profit. Four things are essential to bring about the end in view: First, the assurance of the moral support of all engineering interests; secondly, the necessary financial support; thirdly, the setting up of a really strong and representative honorary committee, composed of men who would give a large amount of time, trouble, and attention to the formation and conduct of the Club; and, fourthly, the finding of a man of experience who could run such a club economically and successfully. No amateur, however good, could fill the bill. The Club would need the best that money could buy; a full-time man of great experience in management, buying and catering, of long and varied knowledge of club management, and a gentleman—in the best meaning of the word—would be essential.

There should be a generous bedroom accommodation, for the country membership will be large; and for the same reason it might be well to have a linking-up arrangement with the Engineers' Clubs in Manchester and Birmingham.

We are glad to announce that a strong preliminary committee, comprising prominent men in the civil, mechanical, electrical, gas, transport, iron and steel, shipbuilding, and other branches of engineering is being formed, in order to explore the possibilities.

As it is vitally important for the framers of a scheme to have some idea of the magnitude of the probable membership, readers who are in favour of such a club are invited to send their names either to the offices of this paper or to Mr. Edmund L. Hill (Secretary of the Federation of British Industries), 39, St. James's Street, S.W. 1, who has kindly consented to act *pro tem.* as honorary secretary to the committee.

Report on Air Ministry Competitions.—The Report upon the competitions between various types of aeroplanes and "amphibians" which took place during August and September last says a great deal with regard to points in design making for safety and comfort. It is noted with satisfaction that very few items of equipment of foreign make were utilised by competitors, and these were practically confined to petrol gauges. The magnetos fitted were all of British design and manufacture, and the Report states: "While there is little doubt but that when a few mechanical details have been improved, the British magneto will be the best in the world, the results of the competitions show that the British magneto manufacturers are now abreast of any of their foreign rivals."

LEGAL.

ELECTRICITY OBTAINED BY FRAUD.

AT Old Street Police Court, S. D. Goldberg was summoned for unlawfully causing to be laid electric lines to communicate with an electric line belonging to the Stepney Borough Council on or about November 8th, and, further, fraudulently abstracting, consuming, and using electricity, the property of the Borough Council.

Mr. G. H. YOUNG, prosecuting, said defendant and two others made application to the Council in writing to be supplied with electricity for certain premises to be converted by the defendant into a billiard saloon. An inspector from the Council, who went for the purpose of removing a meter board, discovered that two wires had been connected with the wire belonging to the Council, and with four lamps, in such a way that the electricity passing through did not go through the meter. The electrician said it was done by Mr. Goldberg's orders. Defendant was seen afterwards, and said the lamps had only been on for an hour or two, and if there was anything to pay, he was willing to pay it.

DEFENDANT said his electrician did it, but he (defendant) was liable as he employed him. It was only a temporary connection, for three-quarters of an hour.

Mr. CLARKE HALL said he was sorry his power to fine was limited to £5 in each case, because he thought it was a gross fraud. Defendant would be fined £5 and £2 2s. costs on each of the two summonses.—*Bethnal Green News.*

THEFT.

HARRY RISLEY, 34, electrician, employed at Bellamy's Wharf, was sentenced to three months' imprisonment with hard labour at the Tower Bridge Police Court on January 6th, for stealing goods valued at £243.—*The Times.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Cost of Living on the Gold Coast.

In the current issue of the ELECTRICAL REVIEW a letter appears from "'Phone Engineer" asking for particulars of life on the Gold Coast. I have spent five and a half out of the past six years there. The climate, as is generally known, is not healthy for Europeans, but if ordinary care is taken it is not as black as sometimes painted. It is very damp all the year round, and produces a good crop of rheumatism and kindred complaints. The heat is not as great as in India or Egypt during the day owing to the moisture, but the nights are hot as a rule. The average temperature is about 90 deg. Malaria is very prevalent, but not serious provided it is not taken too lightly and quinine is taken regularly.

The cost of living is high compared to that at home. Bungalows are usually provided free for a single man, in which case, including a cook, steward, boy's washing, &c., the cost per month will come out at about £15 to £20, according to the style of living. The food very much depends upon the district where one is situated. If on the railway, a seaport, or near either, fresh meat can usually be obtained of a greater or lesser degree of toughness at about 2s. 6d. per lb. Chickens are generally plentiful, as are also eggs and fruit. Tinned goods form a great part of the European's diet—bacon, vegetables, &c., which can be obtained from any of the numerous traders' stores in the colony. Clothing, generally speaking, is dear, and a sufficient supply to last the tour should be taken from home. If "'Phone Engineer" is considering going out to "the Coast" I should be pleased to give him any more particulars he may require.

Mine Engineer.

January 8th, 1921.

[We are much obliged to our correspondent for these useful particulars, and for his offer to give further information. Letters addressed to this office will be forwarded to him.—EDS. ELEC. REV.]

A Generator Problem.

In further reply to "Wireman," I should like to suggest that in addition to testing the voltage across the shunt field, he should also test which is the positive and which is the negative shunt lead. He should also ascertain which is the positive and which the negative machine terminal. This he can easily do by means of a polarised voltmeter. If the voltmeter indicates that the voltage across the shunt field is less than that across the machine terminals, the machine will run self-exciting if the positive field lead is connected to the positive terminal and the negative lead to the negative terminal. If the field leads are connected up in the reverse way, the

machine will not build up, because the voltage generated by the residual magnetism will send a current through the field windings in such a direction as to oppose and destroy the residual magnetism, no matter what polarity it may have.

It does not necessarily follow that because a shunt-wound machine runs as a motor it will also run as a self-exciting generator without altering the connections. It will only do so on condition that the direction of rotation is that suitable for the conditions obtaining. If the machine in question proves to be designed for separate excitation from a 480-V supply, the reason for not building up as a shunt generator is obvious. If connected to a supply, as a shunt motor, it would certainly run, but at a dangerously high speed owing to the weak field.

I do not quite follow "Wireman's" explanation of series and compound connections. It would have been better had he given a sketch of arrangement. The compound winding will perform its function of regulating the voltage according to load, whether the generator is self-exciting or not.

T. A. Robertson.

Glasgow.
January 8th, 1921.

Referring to "Wireman's" correspondence of the 1st inst., in connection with the above, I am of the opinion that the machine referred to is a compound-wound interpole generator, and that the compound winding mentioned by him is actually the interpole winding.

If "Wireman" cares to get in touch with me direct, I shall be pleased to give him any assistance I can in the matter.

C. A. Besley.

39, Newfoundland Road, Cardiff.
January 8th, 1921.

Excessive Charges for Service.

In reply to an application for a ten-point installation of electric light in a small villa about 20 ft. back from a road in which mains are already laid, the electrical engineer of an Urban District Council recently quoted a price of £15, for installation charges.

Together with the cost of wiring, the whole installation would have cost about £41, which is quite prohibitive for houses of this class, and if similar charges are being made throughout the country the immediate future of electric lighting would seem to be very gloomy.

As is most common with public authorities, the letter was abrupt to the verge of rudeness, the applicant being informed that if he decided "to adopt electric lighting this sum, in accordance with the instructions of the Council, must be paid before the work could be put in hand."

It is hardly necessary to say that the applicant did not decide to adopt electric lighting.

X.

January 10th, 1921.

[According to the Electric Lighting (Clauses) Act, 1899, the undertakers can only charge for so much of the service line as may be laid upon the property of the consumer, if the premises are within 60 ft. of a distributing main.—EDS. ELEC. REV.]

German Competition in the Electrical Trades.

We regret that "W. H. M.," in his effort to avoid personalities, should have so poor an opinion of our knowledge of economics. A blow at one's little hobbies is always the most unkindest cut of all, but we take comfort in that "as yet."

If we understand your correspondent aright, he suggests that our determination not to buy German machinery is causing more unemployment in this country. Let us see where this leads us. We refuse to buy from Germany, and for the sake of the argument, cannot, or will not, purchase machinery of other foreign origin. We, therefore, in order to keep our business going, buy the machinery from British manufacturers, and so we increase unemployment, which, as Euclid would say, is absurd.

There is a certain kind of cane used by chairmakers in this country, which, we understand, grows only in Germany. If we were chairmakers, and refused to buy this cane, we should, undoubtedly, increase unemployment. "W. H. M." will readily see the difference in these two cases.

We will do our best to reply to your correspondent's questions.

1. Germany does not intend to pay her war debts, but if forced to do so, can pay with the wealth produced by her agriculture, her mines, her manufacturing industries, and by the profits made in trading with those neutral countries which have been enriched by the war.

2. Yes, and the greater the quantity sent over here, the larger the number of British factories which will close down.

3. We never mentioned the word "rings" in our letter. Rings can either increase the prosperity of a country or be its curse. It depends entirely on the policy of the rings.

4. If "W. H. M." had thought a moment he would not have asked this question; how can our manufacturers dump their goods across a high protective barrier? Apart from this, we doubt if any manufacturers, exposed to free foreign competition and dumping, could ever make their goods in sufficient quantities to dump profitably. We reiterate that the producer is the creator of the real wealth of a country—the agriculturist, the miner, and the skilled artisan—with the assistance of the capitalist, and the trained technical expert. The great distributing systems—ships, railways, wholesalers, retailers, export and import merchants are, of course, indispensable, and, by their enterprise and efficiency, add greatly to the wealth of the country; but injure the producers, either by excessive taxation, strikes, the policy of ca' canny, unrestricted foreign imports, or dumping, and you strike a mortal blow at the prosperity and well-being of our land. At the same time, and what is of equal importance, you are endangering the national security of our country. Has the war taught "W. H. M." nothing? Surely he remembers how, in the early days of the war, our armies were handicapped—little optical glass, less chemical glass, and few explosives, owing to a decaying dye industry. We wonder how many of our lads were sacrificed through the lack of these native industries, strangled by German competition.

One of our correspondents tells us he has sent a copy of your leading article to his local M.P.—an excellent idea, which we have copied, and, in view of the Bill shortly to be presented to Parliament, one we should like to commend to your readers.

London. **E. P. Allam.**
January 10th, 1921.

The correspondence on this subject in your columns is very interesting. With regard to one of the questions asked by "W. H. M." in your issue of the 7th inst., it is, of course, notorious that the "rings" in the electrical industry, and in others, are largely responsible for inflated prices, and also for the restriction of trade, though whether they can be held responsible for the latter in its *present* legal definition is another matter. It follows that they are responsible for some of the unemployment in the country. It is natural that the rings should wish to keep out German and other goods, as their aim is to eliminate competition and fix their own prices accordingly. The buyer and the consumer are, of course, the sufferers. If you and "W. H. M." are agreeable, I would like to get into touch with him. The prejudice against *German* goods is natural enough, but the whole question is very much wider than this, and calls for clear thinking and action.

Play Fair.

January 8th, 1921.

May I refer "All British" and other correspondents to extracts from the last two paragraphs of your leading article in to-day's issue of the ELECTRICAL REVIEW?

"Surely it is a matter of plain common sense . . . . and it should be our earnest endeavour to turn out the maximum quantity of goods at the lowest possible prices. *That is what the Germans are doing already.* [Italics are mine.] Let us beware lest, beaten in war, they defeat us in the arts of peace . . . . and let each 'do his bit.'"

That is what I tried to say in my first letter!

W. H. M.

January 7th, 1921.

The Life of Metallic Filament Lamps.

Is it not about time some protest was made against the metallic filament lamps which at present are being turned out on the market? Wherever one discusses the question, one hears the same complaint—inferiority.

I have burning at the present time two out of six "Brimsdown" lamps bought before the war—one in a table lamp which is continually being moved. The remaining four all burned over three years. There is a legend that the life of a lamp should be 1,000 hours. I have tried all the leading makes, and I should imagine that 250 hours average is about the maximum one can expect from lamps purchased in the last 12 months. As for the half-watt type, these are infinitely worse. I purchased eight ten days ago—six burnt out in three days, and were returned to the factors who supplied them, who also tendered the information that they were having a tremendous number of complaints, and having to return lamps to the makers in hundreds.

Besides concentrating on prices, could not the lamp ring make an effort to see that a consumer gets a fair return for his money, and by so doing help the electrical industry generally?

The failures referred to are not mechanical breakages, but lamps which go out after a short run in perfectly undisturbed positions. Perhaps some large users will give their experience.

January 10th, 1921. **Dudlux.**

Shop Displays.

My attention has been directed to a letter dated December 23rd appearing in one of your recent issues, from the managing director of Messrs. Watson, Marsh & Co. (Hampstead), Ltd. I am sorry that the writer should trouble you with his personal grievances. A vague charge is made against my Association, to which it is impossible to reply in the absence of anything definite. Suffice it to say that Mr. Cohen per-

sonally thanked our solicitors for their help in matters which really related to clients of Messrs. Watson, Marsh, and thanks were also received from the clients concerned.

I should hardly think that the public are concerned with the circumstances under which Messrs. Watson, Marsh & Co. resigned as from April 30th, 1921, from the membership of the N.F.E.A., or the fact that Messrs. Watson, Marsh & Co., were pressing for the rebates under the cable makers' agreement before they became due, and at a time when they themselves had not paid up the contributions to the subsidy fund of the N.F.E.A. I submit that it would be far better if Messrs. Watson, Marsh & Co., instead of writing about "union amongst members" practised loyalty themselves to their own Association.

Leonard G. Tate,
General Secretary.
Electrical Contractors' Association (Inc.).

London.
January 8th, 1921.

A Curious Phenomenon.

Your correspondent's letter *re* gas burners brings to mind a similar case I met with some years ago; this time, however, it was arc lamps. These were repaired during the day and put on test during overtime, *i.e.*, 5.30 to 10 p.m. About 7 p.m., and from then onwards, we were greatly bothered by a continual but intermittent flickering of the arc, accompanied by a "sing" or drone, according as the arc lengthened or shortened. Being then much younger, I was greatly puzzled, though assured by one of the "sparks" that it was due to wireless. I have never met the phenomenon since, and the "spark" being a romancer was not really believed. Perhaps some of your readers may have been up against it also, and have an explanation. The "sing" of the arc certainly supported the wireless theory.

E. N. E. Husbands.

Lincoln.
January 6th, 1921.

A Fiery Test.

The note in this week's REVIEW on a remarkable test of an electric iron recalls a similar but unintentional test which came under my notice. I was called to a large house where "some of the lights had gone out," and on tracing the fault down to the drawing room I found a hole burnt through the oak floor underneath the sofa and the iron—a 3 lb. "Magnet"—under the floor; it had been placed under the sofa out of the way and never switched off. As your article says, the plating had "gone west," but the wooden handle was only scorched. The fuse had been blown by the iron falling on to the flex and burning it through. The heating element was uninjured, and after being cleaned up, the iron was put into service again, and to my knowledge was in use eighteen months afterwards.

Not Burnt Out.

January 8th, 1921.

On page 21 of your current issue the "Electric Heating Co., of Croydon," describe "a remarkable test" of their "electrical iron." A 6 lb. iron was mounted on a wood plank 14 in. wide and 4½ in. thick, and the current was switched on. In 13 hours the iron had become a white hot mass of metal, and had burned its way through the board.

If the current taken by the iron was in excess of the normal rating, then indeed it was a remarkable test. But, on the other hand, if the current was normal, then surely the iron should not become a "white hot mass," but should dissipate its heat when it had reached its best average ironing temperature. I can understand an iron burning the wood, but I do not understand the iron becoming a white hot mass. I shall be glad to hear from the makers on this point, and also to have the views of your readers.

L. O. Meyer.

Bedford.
January 7th, 1921.

Electricity Supply from Surplus Sources.

In your issue of December 24th there is a description of a small hydro-electric plant which is stated to be unique, "inasmuch as there is no other similar plant in this country which feeds surplus energy into a town's public supply network."

Concerning this, I would ask why this should be so. Is there any valid objection to this course being adopted on a large scale? If works all about the country can take a supply of electrical energy from the mains through a meter, is there any reason why a works that happens to have surplus energy should not dispose of it by discharging it into the public supply mains through a meter, and being credited with it?

Some firms have long ranges of boilers supplying steam at low pressure for heating and boiling. If instead of the boilers being pressed to, say, 60 lb. they were pressed to 200 lb., it would require only a few per cent. more heat units, and the steam if passed through an engine or turbine would develop a great deal of electrical energy at merely nominal cost, which could be fed into the public supply mains.

Other possibilities of generating electrical energy cheaply are blast-furnace and coke-oven gas, exhaust from internal-combustion engines, streams, &c., and if all such sources of generating energy were developed, the result in the aggregate would be very large, and the benefit to the country considerable. If it were known that any surplus energy could be passed into the public supply mains, many people and companies who have potential sources of energy would proceed to develop them, and such schemes as the Severn barrage might take a back seat for a time. It has been suggested that companies which use a lot of steam for manufacturing purposes and require very little power should place their works beside other manufacturers who require a great deal of power and have very little use for steam, but moving works involves a large outlay, and it would be unnecessary if surplus electrical energy could be discharged into the public supply mains.

Albert Charles Pain, M.I.Mech.E.

Birmingham.
January 7th, 1921.

[The answer may perhaps be found in the facts, which have been noted in our pages, that power companies have to provide stand-by plant practically equivalent to the surplus power supply; that many works have surplus energy at times and on days—as at week-ends—when the power companies cannot use it; and that consequently the power companies cannot offer a good price to the works for the surplus energy, nor can they sell it to the public at a low rate, in view of the capital charges on plant and mains.—EDS. ELEC. REV.]

A Freemasons' Lodge for Birmingham.

I have heard it mooted for several months that several Freemasons who are electrical engineers in the Birmingham district think it desirable that a lodge should be formed in Birmingham, confined to electrical engineers. I shall be pleased if you will give this publicity, and would thank all those interested to communicate with me.

V. Delebecque.

57, Bridge Street,
Walsall.
January 7th, 1921.

Home Lighting Economies.

With reference to "Voltman's" home lighting economies and Mr. C. A. Copinger's suggestion in the current number of the REVIEW, may I offer the following idea? Instead of connecting several 230-V m.f. lamps in series on a 230-V circuit, would it not be more economical to use 50 or 100-V m.f. lamps (for four or two points respectively) in series? These lamps can, I believe, be obtained in as low a c.p. as 5, taking about 6 watts. Supposing that "Voltman" has four dark corners to light, and uses four 50-V 6 watt m.f. lamps in series; at 6d. a unit this will only cost him 0.16d. per hour—not a ruinous figure!

Vere Burgoyne.

London.
January 10th, 1921.

Preparing Estimates.

Do any of your readers know of an up-to-date text book dealing with the work of preparing estimates for general electrical work and giving suggestive data?

Estimating Engineer.

January 3rd, 1921.

The A.E.G.—Addressing the shareholders at the recent annual meeting, when the report and accounts for 1919-20 were adopted, Herr Rathenau is reported to have expressed satisfaction that the former peace rate of dividend of 14 per cent. had been reached, although he admitted that it was a paper mark distribution, because the earnings were in paper marks. It had been considered necessary to create a new foundation for the benefit of the workmen by the allocation of 12,000,000 marks for the purpose. The donation was prompted by the feeling that the company must recognise that the men had made every effort to increase the production during the difficult situation, the amount averaging 200 marks per head. As to the future prospects, the chairman remarked that the stock of orders was not uniform, but was so far satisfactory. The course of business with the Felten and Guilleaume Co. was developing according to expectations, and the conditions in the case of the other investments were also satisfactory.

Wages Questions in Sweden.—Negotiations are proceeding in Sweden between the Employers' Association and the Electrical Employers' Association on the one hand and the Electrical Workers' Union on the other, with regard to the conclusion of a new agreement for the whole of the country. In the case of electricians employed by installation contractors a minimum wage of 2.85 kr. per hour is now being demanded. It appears that since the end of 1914 the wages of this class of workmen have increased by 265.7 per cent., whereas the cost of living, as shown by the latest figures of the State Social Administration, has advanced by 181 per cent. between 1914 and October 1st, 1920.

BUSINESS NOTES.

Dissolutions of Partnership.—CENTRAL LIGHT AND POWER CO., electrical engineers and general electric lighting and power installation contractors, Friar Lane, Leicester.—Messrs. F. T. Middleton, J. Orton, and T. Wright have dissolved partnership. Debts will be attended to by Mr. J. Orton and Mr. T. Wright, who will continue the business.

HANBURY & WILSON, electrical contractors, 3A, Padiham Road, Burnley, Lancaster.—Mr. C. K. Hanbury and Mr. T. H. Wilson have dissolved partnership. Mr. C. K. Hanbury will attend to debts and continue the business in his own name.

PEERLESS ENGINEERING CO., Cole Hill, Burnley Road, Halifax.—Messrs. J. A. Hogan and H. & E. Blackburn have dissolved partnership as from December 31st, 1920. Debts will be attended to by Messrs. Bairstow and Atkinson, chartered accountants, District Bank Chambers, Commercial Street, Halifax.

HORACE BOOT & PARTNERS, consulting engineers, 7, Victoria Street, S.W.—Mr. H. L. P. Boot and Mr. R. J. Spencer-Phillips have dissolved partnership. Mr. H. L. P. Boot will attend to debts and continue the business.

HAMPSHIRE ELECTRICAL CO., electrical engineers and fitters, 83, High Street, Gosport.—Mr. W. N. Walters and Mr. W. W. Wilson have dissolved partnership. Debts will be attended to by Mr. W. W. Wilson.

UP-TO-DATE ELECTRICAL CO., AND ATTWOOD & CO., electrical engineers, 433, Foleshill Road, Coventry.—Messrs. R. E. Parker and F. B. Attwood have dissolved partnership. Debts will be attended to by Mr. R. E. Parker.

Company Liquidations.—LEYBURN ELECTRIC SUPPLY CO., LTD.—Meeting of creditors is called for January 24th, at the company's offices, Leyburn. Mr. P. Dobson, liquidator.

CANNON MOTOR AND ELECTRICAL WORKS, LTD.—Particulars of claims must be sent to the liquidator, Mr. P. G. Clegg, 10, Cannon Lane, Brighton, by February 8th.

Trade Announcements.—MESSRS. A. KING & CO., of Leith Electric Works, Prince Regent Street, Leith, inform us that they have taken into partnership Mr. Andrew S. Gray, A.M.I.E.E., who has rendered valuable service in their employment for many years as chief draughtsman and, latterly, as manager.

MESSRS H. W. SMITH & CO., LTD., electrical wire and cable manufacturers, of Lydbrook, Gloucester, have opened a sales office at Central House, Kingsway, W.C. Telephone No.: Regent 2368.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., inform us that the telephone number of their London office has been altered to Victoria 5542.

MESSRS. DYER & YOUNG, electrical engineers and contractors, of Stanstead, Essex, inform us that in addition to their tramway supplies, they are making a speciality of rewinding small armatures, field coils, &c., and refitting commutators of all sizes.

MESSRS. DONOVAN & CO., electrical manufacturers and suppliers, of 47, Cornwall Street, Birmingham, owing to increased business, have taken larger premises at 16, Cornwall Street, which will be used as bulk stores of electrical accessories, &c. The offices and sales department will remain at 47, Cornwall Street.

THE BLAKE MOTOR CO., electrical engineers, have opened premises at 169, Yorkshire Street, Rochdale.

THE WESTMINSTER TOOL AND ELECTRIC CO inform us that they have now completed the equipment of their new Westool Works, Putney Bridge Road, and are manufacturing, in all sizes, the Mark 1 pattern of the Westool electric portable drills; the No. 2 size, which has just been completed, it is stated, is giving exceptionally good results. Fitted with a No. 2 Morse taper socket, the tool weighs complete 42 lb., and will drill a hole ¾-in. diameter in mild steel 3¾-in. deep, in a minute. The Westool Mark 1 type drills are fitted throughout with ball bearings, and have an exceptionally short overall length, while giving an effective feed nearly twice that of other electric drills.

MESSRS. BAWDEN & CO., of 45, Newhall Street, Birmingham, who are shortly opening a branch in Melbourne, Victoria, are desirous of getting into touch with British manufacturers who are open for representation in that country. They would also be pleased to receive lists and prices in duplicate of electrical and mechanical supplies.

MESSRS. GUY CHANTRILL & CO., electrical engineers and exporters, have removed to 6, Norfolk Street, Strand, W.C. 2.

Catalogues and Lists.—THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham.—Ten illustrated leaflets, No. 102 to 111, dealing with various types of iron-clad switches and cut-outs, fuse bridges, distribution boards, &c.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C. 4.—Leaflet F. 2397, a priced leaflet illustrating "Doricilite" semi-indirect all-glass pendant bowl fittings; also a "sticker" illustrating the "Kingsway" telephone extension arm.

PATERSON & SERVICE, 33, Bath Street, Glasgow.—List No. A 25, net trade price list of electric lighting accessories, including cables, wires, insulating materials, lampholders, wall plugs, &c.

R. B. HAND & CO., LTD., 63, High Holborn, W.C. 1.—An illustrated price list of "Hand" refill batteries for pocket lamps and torches.

DONOVAN & CO., 47, Cornwall Street, Birmingham.—Export list No. 8,120. An illustrated and priced sheet of electrical accessories, including switchboards, ammeters and voltmeters, cut-outs, lampholders, switches, &c. Prices include packing and delivery f.o.b. British port; c.i.f. prices can be quoted.

SWEDISH GENERAL ELECTRIC, LTD., 5, Chancery Lane, W.C. 2.—Stock lists, No. 26, d.c. and single-phase a.c. motors, and d.c. electric drills, No. 27, two- and three-phase motors, single-phase commutator motors, transformers, &c. Illustrated and priced.

MELDRUMS, LTD., Timperley, near Manchester.—"Meldrum's Magazine." This is the second edition of the magazine, dealing with the destruction of waste of all kinds and the employment of the heat generated. Photographs are used to illustrate various types of destructor made by the firm.

L. G. HAWKINS & CO., 116, Charing Cross Road, W.C. 2.—An illustrated booklet dealing with "Miller" lamps and fixtures and their applications.

PIGGOTT ELECTRICAL CO., LTD., 21, New Bridge Street, E.C., 4.—"Electrical plant" and monthly sale register, dealing with generating sets, d.c. and a.c., motors, dynamos, motor-generators, rotary converters, &c.

ISIS ELECTRICAL CO., 57, Albert Road, Aston, Birmingham.—An illustrated leaflet giving prices of fancy ceiling plates and hooks, and other lighting fittings.

THE B.E CO. (OF LONDON AND BIRMINGHAM), LTD., Hendon House, 57, Upper Thames Street, E.C. 4.—The "Beco" booklet (13 pp.) of electric fires and heating appliances, giving illustrations and prices of a large variety of fires, kettles, irons, soldering irons, &c.

Bankruptcy Proceedings.—G. DOLBY, electrician, 39, East Marsh Street, and 120, Freeman Street, Great Grimsby.—Receiving order made December 31st, 1920, on debtor's own petition. First meeting, January 15th; public examination, February 3rd; both at Grimsby.

Company Registrations, 1920.—Statistics compiled by Messrs. Jordan & Sons, Ltd., 116 and 117, Chancery Lane, W.C. 2, regarding the registration of companies at Somerset House during 1920, include the following:—"Electric, gas, &c.," 194 companies, with a total capital of £4,956,100; "Engineers," 483 companies, capital £11,016,330; "Kinemas," 342 companies, capital, £11,604,06); "Mines, coal, &c.," 334 companies, capital £27,217,362; "Oil," 113 companies, capital £27,210,310; "Railways," 16 companies, capital £1,196,100; "Telephones," 7 companies, capital £1,612,000.

Lead Report.—MESSRS. G. CAWSON & CO., writing under date January 8th, say:—The market this week has been rather disappointing after closing so firm last week. The price of prompt metal reacted to £23 15s., but the closing, however, is firmer again owing to some signs of shortage. Closing prices are:—

Prompt and January ...	...	...	£23 10 to £23 15
February and March ...	...	...	£23 15 to £24 0
April	...	...	£24 0 to £24 5

MESSRS. JAMES FORSTER & CO. say:—Consumers have been inquiring lately for considerable quantities of lead, both for early and forward delivery, and a good business has been done, up to £25 10s. having been reported paid on Tuesday for January delivery. However, in many cases business has been postponed on account of the erratic condition and continued uncertainty of the London market. Consumers generally, we believe, are working on very short stocks.

Foreign Trade.—DECEMBER FIGURES.—The following are the values of imports and exports of electrical goods and machinery in December:—

	December. 1920. £	*Inc. or dec.* £	12 *months*, 1920, *Inc. or dec.* £
IMPORTS.			
Electrical goods, &c. ...	282,276	+ 140,454	+ 621,739
Machinery	1,727,901	+ 13,333	+ 4,941,369
EXPORTS.			
Electrical goods, &c. ...	1,340,282	+ 707,441	+ 5,896,368
Machinery	7,173,029	+3,677,810	+32,716,436
RE-EXPORTS.			
Electrical goods, &c. ...	23,741	+ 11,948	+ 56,442
Machinery	127,109	+ 52,428	+ 778,549

The A.E.G. in Luxemburg.—It is reported that the A.E.G. has purchased for 750,000 fr. an establishment in Luxemburg for the location of the offices and stocks formerly kept at Metz. The company's trading operations for the West of Europe will be conducted from the Luxemburg works.

Work for Unemployed.—The Ministry of Transport has published a statement regarding the carrying out of arterial road schemes as a measure for the relief of the present unemployment. The fund available for free grants to authorities to enable them to proceed with the construction of these roads amounts to £5,200,000. It is proposed to advance 50 per cent. of the cost of the schemes from this fund, and the remainder, if necessary, may be loaned by the Government. The conditions to be observed when grants are applied for are: that the schemes are sound from an engineering point of view, that they have reference to an important road, that the work is necessary, and that not less than 50 per cent. of the total cost will be expended in wages for unskilled men. Schemes outside the Metropolitan area of an approximate total cost of £2,750,000 have been approved.

Calendars.—MESSRS. DOWNES & DAVIES, 1 and 3, Stanley Street, Liverpool, have produced a most attractive wall calendar. "Martha" is a charming and captivating study, and her presence will add tone to any office or private apartments; the date slips are quite unobtrusive.

ALLIED STEEL MAKERS AND FOUNDERS, LTD., have sent us a useful hanging calendar with monthly date slips for 1921, each slip showing views of the allied works at Braintree, Bradford, and Leven.

From MESSRS. A. S. WOLF & Co., electric tool manufacturers, 115, Southwark Street, S.E., we have received one of their serviceable wall calendars; the monthly date slips have a column set apart for daily memoranda. Messrs. Wolf will be pleased to furnish a copy of their calendar to any reader upon request.

MESSRS. W. H. WILLCOX & Co., 38, Southwark Street, S.E., have forwarded us one of their useful "Date Remembrancers," with monthly date slips.

A Dutch Floating Exhibition.—What might be described as a floating exhibition is being organised at The Hague, not only for Dutch traders, but for all European merchants and business men who care to take part in the venture. Last September a "Syndicate for Industrial Fairs by Steamers" was founded, and the *Macedonia*, of 6,100 tons, was chartered as an exhibition ship for the display of all kinds of goods, the total space available for exhibits being 5,000 cb.m. A complete commercial organisation will sail on the *Macedonia*, including departments for accounts, sales, correspondence, credit, banking, a commercial inquiry bureau, &c. All these facilities are at the disposal of subscribers, who will be charged a fee of 2,800 fr. per cb.m. of exhibition space, and a commission of 10 per cent. will be claimed by the syndicate on all business done during the voyage. Two directors of the syndicate will sail on the *Macedonia* in order to control the enterprise, and two competent business men will precede the exhibition ship to herald her arrival and to make all necessary arrangements in every port of call. It is proposed, first of all, to follow the eastern coasts of North and South America. A sum of ten million florins will be necessary if the exhibition is to be carried out on the scale at present planned.—*Reuter's Trade Service* (The Hague).

Italian Dock Electrification.—At a meeting of the Savona Harbour Board, the installation at an early date of electrical ship-unloading plant at the port was discussed. The provision of four sets of electrically-driven coal-discharging plant was also considered; these would be in addition to the 12 sets of apparatus which have already been constructed.—*Reuter's Trade Service* (Rome).

Book Notices.—"The Transport World and Motor Freight Exchange," Vol. I, No. 1, January 6th, 1921. London: Benn Bros., Ltd. Price 4d.—This is the first number of a journal to be devoted to the road carrying industry. Besides being the organ of the industry, it will endeavour to bring transport owners and freight producers together by means of a special section. The articles appearing in this issue include "The Return Load Problem—A solution," "The Attitude of the Railways," "That Ministry Again!"—being an objection to the new motor-car number plates, and an appreciation of the President of the Society of Motor Manufacturers and Traders, Mr. A. S. Mays-Smith.

"The Slide Rule." By C. N. Pickworth. Seventeenth edition. 134 pp., 39 figs. Manchester: Emmott & Co., Ltd. Price 3s. 6d. net.—The preface to this, the seventeenth, edition states that the sustained demand for this very successful work has resulted in an early call for a new edition. Slight revisions have been effected, and descriptions of new slide rules introduced.

"Annual Report of the Board of Regents of the Smithsonian Institute for the year ended June 30th, 1918." 612 pp. + 54 plates. Washington: Government Printing Office (Publication 2,549). Price 75 cents.—Includes a very full survey of the year's work, with an appendix consisting of miscellaneous papers. Among the latter are "The Problem of Radio-active Lead," by Theodore W. Richards, and "Wind Power," by James Carlill.

"The Electrical Engineer's Diary, 1921." Thirteenth edition. London: S. Davis & Co. Price 10s. 6d. post free.

"The Relation Between the 'Bight,' 'Span,' and 'Dip' of Catenaries." By Rollo Appleyard, O.B.E., M.Inst.C.E. Extracted from the minutes of proceedings of the Institution of Civil Engineers by permission of the Council. From the Author.

"An Amazing Presumption; or, an Outrageous Attack on the Great Panjandrum." By Skepticus. 164 pp. London: J. Heywood, Ltd. Price 5s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XXXIX. No. 12. December, 1920. New York: The Institute. Price $1.

"Telegraphy, Telephony, and Wireless." By J. Poole. Pp. vii + 120; 68 figs. London: Sir I. Pitman & Sons. Price 3s. net.

Sample Room at Rotterdam.—H.M. Consul-General at Rotterdam, in a dispatch recently received in the Department of Overseas Trade, states that a small temporary building, measuring 10 metres by 4 metres and 2·25 metres high, is available for use as a sample room for the Commercial Department of the Consulate. United Kingdom firms wishing to have samples of their manufactures exhibited should forward these direct to His Majesty's Consul-General at Rotterdam, at the same time advising the Department of Overseas Trade of any action so taken. It should be noted, however, that samples other than those of "no commercial value" would be liable to import duty on arrival in Rotterdam, and the size of the proposed sample room should also be borne in mind.

New Swedish Cable Company at Korsnaes.—A new company has been formed at Korsnaes for the purpose of taking over Korsnaes Koppartrasd och Kabelfabrik (Copper wire and cable works). The share capital is fixed at Kr. 150,000 in shares of Kr. 500 each.—*Reuter's Trade Service* (Stockholm).

Argentine International Exhibition.—The proposal to hold an International Trade Exhibition in Buenos Aires in 1922 has been received with great favour, and strong Government support is expected. All diplomatic representatives in Argentina are being invited to consider the scheme and to urge their respective Governments to take part. A sum of 10,000,000 pesos is to be raised for the purpose of constructing the buildings, and the greater portion of the amount is already assured.

The exposition will be on a much larger scale than the exhibition of 1910, held during the centenary celebrations, at which British firms obtained orders for locomotives, rolling stock, and machinery to the value of nearly one million sterling. The exhibition will be entirely of a commercial and industrial character, and it is hoped to gather together a representative show of every kind of textile manufacture, general mechanical, chemical, electrical, and chemical engineering exhibits, all classes of machinery, machine tools, agricultural machinery, hardware of all kinds, tractors, paper-making, envelope-making, and printing machines, furniture, and domestic appliances of every kind. Every facility will be given to manufacturers and shippers to engage in trade propaganda, and no efforts are to be spared to make this the most successful exhibition of the kind ever held in any Latin-American country.—*Financial News.*

Motors for Australia.—The Office of His Majesty's Trade Commissioner at Melbourne has forwarded to the Department of Overseas Trade specifications, &c., relating to a call for tenders by the Victorian Government Railways for the supply and delivery of three-phase a.c. motors, starting apparatus and accessories (Contract No. 33,697). Tenders, which should be endorsed "Tender for the supply of Motors, &c.," and addressed to the Secretary for Railways, Spencer Street, Melbourne, must be received by March 2nd, 1921. Local representation is necessary. Copies of the specification, &c., can be seen by United Kingdom firms interested, on application to the Inquiry Room, Department of Overseas Trade, 73, Basinghall Street, E.C. 2. (Ref. 4,188/E.D./P.N.)

Employment of Women, &c., Act, 1920.—The Chief Inspector of Factories notifies the following changes which are effected by the above Act:—Under Section 1 the employment of any child under 14 years will be illegal on and after January 1st, 1921, unless the child was already so employed at that date.

Section 1 also prohibits the employment at night of any young person or woman, except that young persons over 16 years of age may be employed on work which, by reason of the nature of the process is required to be carried on continuously day and night, in the following industries:—(*a*) Manufacture of iron and steel; processes in which reverberatory or regenerative furnaces are used; and galvanising of sheet metal or wire (except the pickling process); (*b*) glass works; (*c*) manufacture of paper; (*d*) manufacture of raw sugar; (*e*) gold mining reduction work.

The practical effect of these provisions is:—(*a*) To raise the age for night work from 14 to 16 years in the case of blast furnaces, iron mills, paper mills, and glass works; (*b*) to prohibit night work for any young persons in letterpress printing works, electrical stations, and china clay works.

Australian Merchants and Surprise British Deliveries.—The *Exchange Telegraph* Melbourne correspondent says:—"Complaint is made by Australian merchants and their bankers that, although when orders were placed 12 months ago with English manufacturers they were unable to give an undertaking when they would be likely to be fulfilled, goods are now being delivered without a word of warning by cablegram or letter, the manufacturers being unable to find a market elsewhere. In the meantime the importers at this end have in many cases obtained stocks elsewhere, and consider it is doubtful whether they are under a legal or moral obligation to accept the merchandise. However, they have been doing so. The question of imports was discussed in an interview between Mr. Hughes and members of the associated banks, but no action was decided upon. It is likely, however, that importers will find it still more difficult to finance shipments unless inwards trade declines quickly in volume.

Tradesmen Using the Royal Arms.—The *London Gazette* for January 4th contains lists of tradesmen in London and elsewhere who hold appointments to Royalty with authority to use the Royal arms.

American Dumping in Norway.—The general depression which is affecting Norwegian industries in general, is also hitting the electrical manufacturing works in that country. Questioned on the subject about a week ago, Mr. Ellerstorfer, of the Norsk Elektrisk and Brown-Boveri, of Christiania, is reported to have stated that the company was not receiving any large contracts, as the orders offering were being placed in other countries. It was estimated, he said, that State and municipal orders for a total of 18,000,000 kr. had been allotted to Germany and the United States during the past four months. The former was able to compete on account of the low value of the mark, while the Americans were practising dumping methods. If conditions did not change and many new orders were not obtained, it would be necessary for the company to restrict working, probably in February.

Scientific Time Saving.—A higher appreciation of the value of time in the scientific management of industry as a means of reducing costs of production was advocated in an interview (reported in *The Times*) by Mr. D. B. Morison, chairman of Messrs. Richardsons, Westgarth & Co., Ltd.

The most striking losses of time, he said, occurred at the starting and stopping of each working shift, but still more serious was the loss resulting through all sorts of useless and unnecessary movements by men when doing light work, and by their neglect to utilise their strength to the best advantage when doing heavy jobs. As examples, he mentioned that at their own shell shop at Middlesbrough in the early days of the war their output of 8 in. shells stuck for some time at a weekly average of 350. Careful investigation proved that quite a lot of energy was being wasted, particularly in the handling of the shells and the distances through which they were moved between the various operations. When suitable rearrangements were made, the output went up, as if by magic, to 700 a week, and eventually to 1,000. A similar case that lately came under his notice was that of the stamping of multi-throw crank shafts for motor cars. In this country a good output for a certain crank shaft was 100 per shift of nine hours. In America, with practically the same machinery, the output was 700 per shift.

"These instances," remarked Mr. Morison, "are indicative of what can be done, and, if more attention were given to the art of saving time, a great step forward would be made in cheapening production. That country which best appreciates the full meaning of 'Time saved is time gained,' and acts upon it, will be the first country to relieve its unemployment and the first to recover from the ravages of the war."

Testing Electric Detonators.—Attention is directed by the Mines Department to the practice of testing low-pressure electric detonators by passing a small current of electricity through them in series with a galvanometer. Explosion of the detonator has resulted in some cases in injury to the operator. All danger can be eliminated by placing the detonator to be tested in a strong iron pipe or other suitable receptacle before passing the current through it. By this simple precaution the danger from flying fragments of the metal tube of the detonator is entirely done away with, and it is desirable that all persons engaged in such an operation should be warned of the attendant danger and the ready means by which it can be avoided.—*Board of Trade Journal.*

Employment of ex-Gunners.—A certain proportion of the Royal Artillery Commemoration Fund is devoted to aiding ex-artillerymen and their dependents. Part of the scheme is the employment exchange for finding suitable work for ex-gunners, and in connection with this "Gunners' Friends" have been established in various parts of the country to get into touch with any men who are unemployed, and also to persuade local employers to find these men suitable work. More of these "friends" are required, and those who are willing to be enrolled are asked to communicate with The Employment Department, R.A. War Commemoration Fund, 50, Warwick Square, S.W. 1.

High Cost of Production and Slackened Demand.—Writing in *Unity* on "Increased Output and Industrial Efficiency," Mr. Charles Tennyson, C.M.G. (Deputy Director, Federation of British Industries), says:—

"One of the reasons why manufacturers are finding it difficult to dispose of their goods is that the costs of production have risen to a height which the consumer appears to find prohibitive. The principal reason for this increase in cost is undoubtedly the fact that wages have risen in money value to two or three times the pre-war level, while in many cases the actual production per man has not increased, but has rather decreased, owing to the reduction of working hours and other reasons. This means a very great increase in the cost of labour per unit of production. The production cost of every article is largely, indeed very largely, composed of labour costs. Even in the case of raw material used for the finished product, such as a mineral, the cost is very largely the cost of labour required to extract it from the ground. Similarly the cost of transport is built up of the actual operating labour and of the cost of labour employed in producing the fuel, rolling stock, permanent way, ship, or other means of conveyance."

Industrial Courts of Inquiry.—As there appears to be misunderstanding in some quarters on the subject, it may be advisable to explain the position of Courts of Inquiry under the Industrial Courts Act, 1919.

The two principal permanent features of the Industrial Courts Act, 1919, are the provisions which:—

(*a*) Set up a permanent Court of Arbitration (termed the Industrial Court) to which recourse can be had by parties to industrial disputes, if both parties to the dispute consent. In this connection certain alternative methods of settling disputes are provided.

(*b*) Empower the Minister of Labour in case of disputes, whether apprehended or existing, to appoint a Court of Inquiry, one of the objects of which is to put before the public an impartial account of the merits of the dispute.

The Industrial Court is a permanent arbitration tribunal to which differences are referred for determination by consent of both sides. A Court of Inquiry is a body appointed by the Minister of Labour *ad hoc* to inquire into a particular dispute, irrespective of whether or not the dispute has been reported to the Minister. While, in appointing a court, the Minister would, in accordance with the policy of the Department, endeavour to secure the concurrence of both sides to that course, such consent is not necessary under the provisions of the Act. A Court of Inquiry consists of a chairman and such other persons as the Minister may appoint, or the Court may consist of one person only. Under the Conciliation Act, 1896, the Minister of Labour had power to cause an inquiry to be made into the facts and circumstances of a dispute, and this course was adopted in certain instances.

The provisions of the Industrial Courts Act with regard to the appointment of Courts of Inquiry are directly due to the recommendations of the original Whitley Committee on the relations between employers and employed. This committee, in the course of their inquiries, gave consideration to the part which should be taken by the State in the event of those directly concerned in industry being unable to adjust their differences themselves. The committee pointed out that the interests of the community may require that there should be an unbiassed and independent examination of facts and circumstances connected with any dispute between employers and employed ,and they recommended:—

"Where the parties are unable to adjust their differences, we think that there should be means by which an independent inquiry may be made into facts and circumstances of the dispute, and an authoritative announcement made thereon, although we do not think that there should be any *compulsory* power of delaying strikes and lock-outs."

Courts of Inquiry have been appointed under the Industrial Courts Act with successful results in the case of (1) coal trimmers, (2) transport workers. It will be observed that the Industrial Courts Act, following the recommendations of the Whitley Committee, contains no powers to delay a strike or lock-out; nevertheless it appears desirable that, wherever practicable, parties should avoid proceeding to a stoppage of work pending investigation by such a court.

Chinese Trade.—*The Board of Trade Journal* of December 30th, gives some impressions received by Mr. H. H. Fox, C.M.G., H.M. Commercial Counsellor in China, after a six months' tour of the principal commercial and industrial centres of this country. Mr. Fox found an unexpected degree of interest being taken by British manufacturers in China, but most of the trade was done through merchant houses; it is thought advisable that British manufacturers should watch with closer attention the changes in demand and fashion. The best channel for the sale of British goods is through the British merchant firms who have their own houses in London or Manchester, with branches at least in Shanghai and Hongkong, and preferably in Tientsin and Hankow as well. Many of the Chinese merchant houses are old-established and reliable, possessing an intimate knowledge of the requirements of the country through long and often costly experience; but the difficulty is that there are not enough to serve the interests of all the British manufacturers, but their number is increasing, and will increase further as the trade develops and British goods come forward more freely. Mr. Fox recommends a wider use of the information collected by the Department of Overseas Trade. He found abundant testimony to the commercial honesty of the Chinese and the satisfactory nature of the business done with China. He thinks, however, that credit in this respect is largely due to the British merchant houses of China which stand between the British manufacturer and the Chinese dealer, taking the risk of fluctuations in exchange and prices, carrying the goods when consignees are found wanting, and supplying the necessary guarantees of measure and quality. These considerations make it difficult to recommend direct dealing with native firms, although there are, of course, exceptions. In the engineering business, more particularly in the electrical branches, Mr. Fox found a gratifying activity among many of our largest manufacturers. He points out that, in the case of a vast and partially developed country like China, immediate results must not be looked for, but once a firm's position is consolidated an expanding trade is assured. The determining factor in the sale of goods to China in the past was cheapness in which direction British traders were handicapped. With the industrial growth of the country, however, the Chinese will want and be able to purchase a better class of goods. The Chinese know British goods to be of sterling quality, and if the standard is maintained, foreign competition need not be feared.

Trade with Mexico and Ecuador.—Complaints are being made in Mexico that it is next to impossible to obtain supplies of British-made electrical materials, the local impression being that the United Kingdom is neglecting her overseas markets in order to fill her home demand. This is strongly resented, and American travellers are receiving more attention than would otherwise be the case. The country is being inundated with electrical and other price lists from United States firms, who are promising speedy deliveries. The situation in Ecuador is much the same. There is a demand for electric light and power cables, wires and switches, in Quito, but it is said that an English catalogue or price list is rarely seen.—*The Times Trade Supplement.*

Wages in the Tramway Industry.—The Secretary of the Ministry of Labour states that the Minister of Labour has decided, in pursuance of his powers under the Industrial Courts Act, 1919, to appoint a Court of Inquiry in connection with the dispute in the tramway industry arising out of the workers' claim for an increase in wages. The Court will be constituted as follows:—The Right Hon. Sir David Harrel, G.C.B. (chairman), Sir Herbert Rowell, K.B.E., Messrs. Harry Gosling, C.H., G. H. Hume, and W. F. Purdy, O.B.E., J.P. The terms of reference are:—"To inquire into the causes and circumstances of the dispute between the employers' representatives and the workpeople's representatives on the National Joint Industrial Council for the Tramway Industry, and to report thereon to the Minister of Labour." The secretary is Mr. H. C. Emmerson, Ministry of Labour, Montagu House, Whitehall, S.W. 1., to whom all communications should be addressed.

A preliminary meeting was held on January 11th. Certain points of procedure were settled, and it was agreed that the inquiry should be held in public. The Trade Union side will open the case at the first meeting of the Court on January 26th, at 10.30 a.m.

A New Year's Party.—On January 1st a New Year supper party was given by Mr. H. P. Girling, M.I.E.E., to his garage, electrical, and foundry employés. It was held in the commodious garage building, which was suitably decorated with flags and evergreens and with carpets laid on the cement floor—an excellent room for the purpose. About 60 sat down to supper, which was followed by a short address by Mr. Girling, who expressed his pride in having got together such a fine spirited staff of employés. He also made the pleasing announcement that he hoped shortly to pay all employés still under him a bonus of 5 per cent. on the wages earned during the last financial year.

Protection of Key Industries.—The Government's Bill dealing with the prevention of dumping and the safeguarding of key industries, as well as with the very difficult problem of collapsed exchanges, is ready to be introduced as the first measure of the new session. No list of the products of which it is proposed, in the interests of our key industries, to prohibit the importation is yet available.—*The Times.*

For Sale.—Islington Borough Council Electricity Department invites offers for one 120-kW horizontal compound engine, together with fly-wheel alternator and exciter; Farnworth Urban District Council has for sale a 250-kW direct-coupled Belliss-Morcom-British Westinghouse dynamo, complete with Ledwards condenser, pumps, switchboards, &c. By direction of the Disposal Board, Ministry of Munitions, Messrs. L. Farmer and Sons will conduct an eight-day sale by auction, commencing February 8th, at the Royal Arsenal and Dockyard, Woolwich, of engineering machine tools, plant, and machinery, electrical equipment, telegraph, telephone and wireless stores, &c.; Mr. M. Marshall, by direction of the Disposal Board, will sell by auction on January 24th and following days, at the Central Stores, 83, Georgetown, near Glasgow, a quantity of engineering and electrical plant, including motors, generating sets, electrically-driven machine tools, &c. Assets Auctions Co., Ltd., will sell by auction on January 20th, at 119-121, Newington Causeway, S.E., a quantity of electrical goods, including motors, generators, bells, conduit, &c. See our advertisement pages to-day.

New Italian Company.—The Department of Overseas Trade states that 11 important Italian manufacturing and electricity supply undertakings have formed a company, with a capital of 5,000,000 lire. The objects of this company, which has been named the Società Italiana per l'Accumulazione Termoelettrica, Milan, are the manufacture of thermal storage electric cooking ranges and all other heating apparatus for household and industrial purposes.

The E.P.E.A. Award.—As the result of conferences with the non-complying local authorities the date for strike notices to take effect has been postponed. In the case of the South Wales undertakings the deferred date is January 21st, and for the West Midlands undertakings January 26th. Whilst going to press we were informed by the secretary of the E.P.E.A. that it had been decided definitely to withdraw the services of the Ilford technical staff at 10 p.m. yesterday (Thursday).

LIGHTING AND POWER NOTES.

Ammanford.—PROV. ORDER.—The Urban District Council is applying to the Electricity Commissioners for a special order to authorise the Council to generate and supply electricity within the urban district.

Ashford (Kent).—PROPOSED ELECTRIC LIGHTING PLANT.—The Urban District Council has decided to obtain an estimate for the installation of an electric lighting plant at the gas works, together with the probable profit or loss to the ratepayers on such an undertaking.

Bacup.—LOAN.—Bacup Town Council has resolved that application be made to the Electricity Commissioners for sanction to the borrowing of £30,000 for the purpose of extending the electricity undertaking.

Barrow.—HYDRO-ELECTRIC PROPOSALS.—At a Town Council meeting on January 3rd, the Electricity Committee's recommendation that the necessary preliminary steps be taken to obtain a Provisional Order from the Electricity Commissioners for powers to proceed with the scheme for the utilisation of water power (River Leven) at Backbarrow, and that the electrical engineer be instructed to prepare plans, detailed estimates, &c., was referred back for further consideration. The recommendation that a consulting engineer be engaged to prepare and submit a report on the proposed scheme was also referred back.

Blackburn.—COST OF STATION.—The Electricity Committee has approved revised estimates amounting to £850,000, for the completion of the new electricity generating station and installation of plant. The Council is applying to the Electricity Commissioners for sanction to borrow £600,000, being the difference between the amount already sanctioned, and the amount of the new estimate.

Bolton.—SLIP-JOINT CONDUIT PROHIBITED.—At a meeting of the Electricity Committee the electrical engineer reported upon the practice of certain contractors of using slip-joint conduit in the wiring of premises for electrical installations, which he regarded as unsatisfactory. It was decided to give notice to all electrical contractors in the borough that, on and after March 1st next, the Corporation will not approve of any installation in cases where slip-joint conduit has been used, and this regulation is to be embodied in the general conditions and regulations under which the Corporation will supply electricity.

Bradford.—MAINS EXTENSIONS.—The Electricity Committee is asking the Corporation for general authority to undertake the provision of extensions of mains to new properties and other new supplies, at an aggregate cost of £10,000.

Burnley.—NECESSITY FOR EXTENSIONS.—On January 6th, the chairman of the Electricity Committee spoke of the necessity for an early extension of the electricity undertaking. The electrical engineer said the present generating capacity was 5,250 kW. Additional plant was on order which would bring this to its maximum capacity, viz., 8 250 kW. He anticipated plant capable of generating an additional 8,000 to 10,000 kW would be necessary to meet probable requirements during the ensuing five years.

WORK FOR UNEMPLOYED.—At a meeting of the Town Council on January 6th, when the unemployment problem was considered, Mr. Sutcliffe said they had work in the electricity department which would provide full-time employment for about 400 men if they could get a sufficient number of cable jointers. Nearly 300 people wanted electricity in their houses, but they had not men enough to carry out the work.

Burton-on-Trent.—LOAN.—Application is to be made by the Corporation to the Electricity Commissioners for sanction to borrow £36,000 for supplying neighbouring districts with electricity.

Church Stretton.—PROPOSED PRICE INCREASE.—The Church Stretton Electric Supply Co. has notified the Urban District Council that it has applied to the Ministry of Transport for permission to increase the charge for electricity for lighting purposes from 10d. per unit to 1s. 2d.

Continental.—BAVARIA.—According to a report from Munich, the Bavarian Finance Minister has discussed with an American business man the question of raising a large loan in the United States in order to build works to harness the hydraulic power of the Walchen See in the Bavarian Alps and of the middle course of the Isar. In financial quarters a sum of 20,000,000,000 marks is talked of. The sum seems very big if it is remembered that about 1,000,000,000 marks have been judged as necessary fully to construct the works. Nevertheless, the fact that an offer has been made to America to cede Bavarian water-power as a mortgage appears to be a most important economic and political matter. The waterfalls and torrents in the Bavarian Alps could produce immense power and lead to the electrification of all the railways. It is further stated that England is interested in the matter, and this may lead to competition.—*Daily Telegraph.*

It is reported that the Government has accepted the offer of American and French capitalists to finance the above scheme.—*Evening News.*

ITALY.—His Majesty's Consul-General at Milan reports that the Società Idroelettrica Cisalpina, Milan, formed in March, 1919, with a capital of 2,000,000 lire paid, has decided to increase its capital to 30,000,000 lire by the issue of 56,000 new shares at 500 lire each, for the purpose of carrying out the projected hydro electric plant in the Liro Valley, Valtellina.

Crewe.—HOUSE WIRING.—The Town Council has referred to the Electric Supply Committee a proposal that the Corporation should undertake the wiring of private houses.

Derby.—DIRECT LABOUR.—The question of extending the power station buildings by direct labour was debated at a meeting of the Town Council on January 5th, when a report in favour of this method was presented, with a recommendation to appoint a works manager at a salary of £500 a year. The chairman of the Electricity Committee strongly opposed the proposal to employ direct labour, urging that there were no technically skilled hands of the type required for such work among the unemployed. Men would not leave the employ of contractors to work for the Corporation. There would also be a difficulty in getting the necessary materials. Mr. W. R. Raynes declared, however that there would be no difficulty in getting either the

men or the materials. The officials of the men's Union in the town had promised to help the Corporation to start a works department. The proposal was carried by a large majority.

Doncaster.—Concession to Kinemas.—The Electricity Committee recommends that picture theatres with continuous performances of not less than seven hours each week-day, shall be allowed a discount of 10 per cent on all energy supplied at kinema rates. The discount is to take effect as and from December 1st last.

Dover.—Permission to Supply Electricity.—The Town Council having received from the Deal and Walmer Gas Co. the authority for the supply of electricity to Deal if the supply is three-phase, alternating current, has replied that the Council can only supply single-phase at 100 periodicity.

East Ham.—Loan Sanctioned.—The Town Council has received sanction to a loan of £5,428 for mains.

Ellesmere Port.—Bulk Supply.—The District Council is in negotiation with the Mersey Power Co., Ltd., for a bulk supply of electricity for the district. The Ministry of Transport has been asked for an extension of time for the carrying out of the compulsory provisions included in the Ellesmere Port and Whitby Electric Lighting Order, and has also been asked to urge the company to expedite the negotiations, with a view to an early supply of electricity being forthcoming.

Grampian Electricity Supply Scheme.—Falkirk.—At a conference, on January 7th, attended by representatives of the burghs of Falkirk, Stirling, Grangemouth, Alloa, and Armadale, it was agreed to ask the Electricity Commissioners to secure provision being made in the Grampian Power Co.'s bill whereby the burghs would be able to get a supply, if necessary, under conditions and on terms to be mutually arranged.

Forfar.—During a discussion of the Grampian scheme, it was suggested that the town should generate its own electricity, and a committee was appointed to consider the whole question.

Dundee.—Regarding the proposed provisional order, Mr. Harry Richardson, Corporation electrical engineer, informed the Electricity Committee that in his opinion were the order passed in its present form, the syndicate would have power to erect a steam plant in [the vicinity of the city boundary and generate power there. There was, from the Dundee point of view, great danger in the Bill. Once the syndicate had electricity to sell, it could come right into the city area. The syndicate might cut its prices in order to get a footing inside the city area. It was decided to petition against the granting of the Order.

A recommendation that orders be placed at once for steam plant for the extensions at Carolina Port was agreed to. Referring to a suggestion that the contractors should allow for any drop in the price of material or labour, Mr. Richardson said he preferred getting a fixed price.

Glasgow.—Electricity Shortage.—The Corporation's electricity supply will not be in full working order till the end of the month, when the Electricity Department states that the present restrictions will be removed. The breakdown at Dalmarnock is more serious than was at first thought, and only by special permit will power supply be available on working days between 2 and 5.30 in the afternoon. Consumers who can change to night shift working have been recommended to do so, and those who use electricity for heating have been asked to reduce consumption to a minimum between the above hours.

London.—Fulham.—Owing to the unsettled state of the markets, the Electricity and Lighting Committee recommends that no annual contracts for the supply of electrical and engineering stores be entered into, but that the electrical engineer be instructed to purchase in the open market at the lowest prices obtainable as and when required.

Maidenhead.—No Opposition to Company.—The Town Council has decided not to oppose the application of the Bourne End and District Electricity Corporation, Ltd., for an order to supply electricity in the Cookham area for which the Council has powers.

Newark.—Electricity Scheme.—Mr. C. H. Wordingham, consulting engineer to the Council, has expressed the opinion that it would be more costly to bring electricity in bulk from Nottingham than to have a generating station at Newark. He did not consider the river Trent could be relied upon to give a consistent power, and he advised the generation of electricity by steam. He suggested a scheme for Newark which could be developed in three stages, and the initial capital expenditure would be £158,500. The total cost per unit sold would work out at 2·29d., but at the end of five years the charges would be reduced to 1·45d. In the second stage there would be an increase of £42,750 on the capital expenditure for the larger plant, and at the end of five years, the third stage, involving an expenditure of a further £122,000, would be required. No action has been taken either for or against the scheme, but it is stated that the firms in the Newark district will be circularised and asked to express their opinions upon it.

Newport (I. of W.).—Price Increase.—In reply to the protest entered by the Town Council against an application by the Isle of Wight Electric Light and Power Co. for permission to increase charges for electricity to 1s. per unit, the Ministry of Transport states that it considers the increased charge, which has been approved, quite reasonable.

Southport.—Electricity District.—The Southport Town Council has decided against the recommendation of the Electricity Committee in favour of the proposed inclusion of the borough in the area of the suggested Mersey and West Lancashire Joint Electricity District. The Corporation feels it advisable to wait for the new Bill which is expected to be brought forward early in the next session to see how electricity undertakings are to be dealt with financially. At the same time, the Council has decided to instruct the town clerk to represent Southport at the inquiry to be held by the Electricity Commissioners in Liverpool on January 25th.

Wimbledon.—Report on Undertaking.—The Town Council has decided to engage Mr. Charles P. Sparks, at a fee of £120, to advise whether extensions to the undertaking are necessary, and if so, to what extent; whether it is necessary to change the system of supply, and if so, in what manner; whether any economies can be effected in the working; and whether it would be beneficial to the undertaking to link up with some other works, instead of extending the generating station. The Council has offered to purchase the undertaking of the Fixed Price Lighting Co., Ltd., for £4,000, but the company considers the offer inadequate.

Windermere.—Price Increase.—As a result of the protest of the Urban District Council against the application of the electric light company for power to increase the charge for electricity to 1s. 3d. per unit, the Ministry of Transport has fixed the price at 1s.

Watford.—Transfer of Supply Powers.—The Urban District Council has agreed to purchase from the Chesham Electric Light and Power Co. the latter's powers to supply electricity to the parish of Kings Langley for £300.

TRAMWAY AND RAILWAY NOTES.

Australia.—Trade Union Proposals.—At a conference held in Melbourne, a number of representatives of tramway employés' Trade Unions resolved that steps be taken to form one big Union for the whole of the tramway workers in the Commonwealth. This would be effected by amalgamating existing Unions with the Australian Tramway Employés' Association, which has branches in a number of the principal towns of Australia.

Bradford.—Railless Cars.—Because of the high cost of ordinary tramway track renewal, and with a view to economy for the future, the Bradford Tramways Committee has authorised the general manager (Mr. R. H. Wilkinson) to apply to the Ministry of Transport for power to extend the existing railless car system on the Idle, Eccleshill, and Thackley routes. This means substitution of railless cars for the existing service of ordinary railed cars. The new double-deck railless car will be used, and it is proposed to run 12 such cars in place of the eight ordinary cars now serving these three districts. All the lines on these routes are marked down as needing relaying, and it is felt that, even allowing for the cost of the new railless double-deck cars, the system will be a great saving as against the cost of renewing track.

Doncaster.—Track Renewals.—The Tramways Committee recommends that £12,000 be borrowed with the sanction of the Ministry of Transport, for repairing the single track, and the laying of another track alongside on the Balby route from Cleveland Street to a point beyond Balby Bridge.

Gateshead.—Opposition to Transport Scheme.—The Town Council has decided to oppose the Durham County Council's Transport Bill, which seeks powers to run cars and omnibuses on certain routes in Gateshead. So far as the linking up of the proposed tramways with the Gateshead and District Tramways was concerned, the Council saw no necessity to oppose the Bill, but it considered that the proposal to provide and work tramways in the borough was objectionable, and should be strenuously opposed. The Council declined the application of the County Council for consent to its proposals to lay down tramways at the Low Fell boundary.

Halifax.—New Loop Required.—Queensbury District Council has asked the Tramways Committee to construct an additional loop on the Queensbury tramway track in order to avoid car stoppages in bad weather at the exposed point at Stocks Gate, where two cars were blown over recently.

Resignations from Committee.—At a special meeting of the Tramways Committee, on January 7th, to consider the position created by the Town Council's repeated refusal to accept the recommendations of the appointment of Mr. J. Galloway as general manager for a year and the payment of £250 per annum for three years to Mr. J. D. Caird, traffic manager, who is incapacitated by illness, Alderman C. F. Spencer (chairman of the Tramways Committee), Alderman A. Broadley (vice-chairman), and Mr. R. Stirk (chairman of the Tramways Sub-Committee) resigned office, on the ground that, as a result of the Council's general attitude to the Tramways Committee, they could not continue their work. Alderman Spencer has been chairman for many years.

Liverpool.—Losses on 'Buses.—At the City Council meeting, on the 5th inst., the chairman of the Tramways Committee stated that it was estimated that on the past year's working there was a loss on the motor-'bus service of £40,000, but that at present it was only intended to withdraw the 'buses from the Moss Lane and Lawrence Road routes.

Sunderland.—Extensions.—Extensions are being carried out at the Philadelphia depôt of the Sunderland District Tramways, Ltd., with a view to developing the resources of the undertaking. The depôt has been extended to accommodate 12 more cars, and new workshops have been erected. Eight new cars have been purchased from the Brush Manufacturing Co., Ltd., Loughborough, with electrical equipments by the British Thomson-Houston Co., Ltd.

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—New Wireless Station.—The Department of Railways will shortly begin the construction of a powerful wireless station, which will be capable of transmitting messages to North and South America and to the Congo.—*Reuter's Trade Service* (Brussels).

Caucasus.—Wireless Telegraphy.—It is reported that communication has been established between Tiflis and Paris by means of wireless telegraphy.

China.—Wireless Chain.—According to the London correspondent of the *Shanghai Times*, writing in the London *Daily Mail*, a fine spirit of enterprise is being shown in the establishment of a chain of wireless stations which will link Peking, the seat of the central Government, with Kashgar, 3,000 miles away, in Chinese Turkestan. Kashgar will then be within reach of the wireless stations in India, and so with other countries. The scheme is being carried out by Marconi's Wireless Telegraph Co., Ltd., to the order of the Chinese Government. One high-power station has been equipped at Urga, in the Province of Kansu, 800 miles from Peking, and these two places are already in communication. Urga is also in touch with Shanghai and Hankow, and messages can be received from the long-distance stations in America. Another similar station is being established a thousand miles farther on at Urumchi, and it will be in operation in about three months' time. Subsequently the terminal station of the series will be erected at Kashgar.

Germany.—Portable Telephones.—A new portable telephone will give Berlin subscribers an opportunity of telephoning from any room, says *The Times*, by means of an apparatus which can be carried from room to room. The new fitting is to come into use immediately, and the cost is to be small.

India.—Telephone Extension.—A Government telephone service has been established between Bombay and Surat, says *Indian Engineering*; the service was inaugurated for public use on December 10th last.

Meteorological Forecasts.—New Service.—Early in the New Year a system of wirelessed weather reports from ships of various nations at sea will come into effect. Col. E. Gold, assistant director of the Meteorological Office, states that a code had been agreed upon by weather experts of France, Denmark, Sweden, Norway, Holland, Italy, Spain and Great Britain. Reports will be sent from ships by means of groups of figures, and, so far as this country is concerned, the figures will be decoded at the Air Ministry in Kingsway, W.C. At first the reports will come from the North Atlantic, and what is chiefly looked for is much greater accuracy in forecasting weather changes. In time, too, ships should be able to plot their own charts of the weather ahead of them from point to point.

New Wireless Service.—England to France.—A new public telegraph service between England and France was opened on January 8th. High-speed duplex wireless transmission will be employed, and the service will be conducted by Marconi's Wireless Telegraph Co., Ltd., and the Compagnie Générale de Télégraphie Sans Fil, these companies operating under licences from the British and French Governments. The current telegraph rates between the two countries will apply. Telegrams to France intended for transmission by this new service may be handed in at all times at the Marconi Co.'s London offices, Fenchurch Street, and Marconi House, Strand, and at any postal telegraph office within the United Kingdom. Messages so tendered must be marked "*via* Marconi." For this service high-speed automatic apparatus such as was used so successfully between Geneva and London during the sitting of the Assembly of the League of Nations will be employed.

A *Reuter's Trade Service* telegram from Paris states that the rate of transmission attained during the opening day was 175 words per minute.

France.—New Wireless Station.—The first stone of what will be, according to the *Daily Telegraph*, the most powerful wireless telegraph station in the world, was laid at Sainte Assise, between Cesson and Mélun, on the 19th inst.; its construction will take at least two years.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen.—February 21st. Corporation Waterworks Department. Electrically-driven pumping machinery. Specifications, £5 (returnable), from Water Engineer's Office, 41½, Union Street, Aberdeen.

Australia.—Sydney.—January 31st. Municipal Council. h.p. and l.p. cable (specification No. 628). Electric Lighting Department, Town Hall, Sydney.

South Australia.—P.M.G.'s Department. March 2nd. Telephone parts, Schedules 558 and 559; telegraph and telephone material, Schedule 560. (January 7th.)

Melbourne.—March 31st. Electricity Commissioners. Plant for the Morwell power scheme. Telephone wire and pin-type insulators. (See this issue.)

Belgium.—Commune of Ixelles at Brussels. 5,000-kW, 5,000-V, 3-phase alternator, exciter and condenser. A copy of the specification (in French) may be seen on application to the Department of Overseas Trade (Room 48), 35, Old Queen Street, S.W.1.

January 19th. The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Supply of telephone commutators and other telephonic apparatus. The specification (No. 545) may be obtained for 1.75 francs from the above address.

February 1st. Municipal Council, Antwerp. Rotary converters with switchboard, for No. 77 Wharf of the Bassin Canal. Specification in French can be seen at the Inquiry Room of the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

Municipal authorities of Wenduyne-sur-Mer, Western Flanders. Conversion of the local electricity supply from continuous to alternating current, together with the supply of about 350 electricity meters, 30,400 lamps and 20 electric motors. It is possible that a small transformer station will later be required.

February 11th. Municipal authorities of Tirlement. Electricity supply in the town; (1) the supply of electrical energy; (2) the establishment of a distribution system; and (3) the concession for the supply of electrical energy for lighting and power purposes. Specification from the Secretariat Communal, Tirlement, on payment of 30 fr. The municipal authorities will decide as to the scheme to be adopted after the tenders have been opened.

Chester-le-Street.—January 25th. Urban District Council. Wiring 512 houses, feeder cables, overhead mains, equipment for sub-station. (See this issue.)

Edinburgh.—January 24th. Electricity Supply Department. Circulating water pipes and valves for the Portobello generating station, Specification No. 30. (January 7th.)

Fife.—January 20th. Education Authority. Electric lighting and heating work at Park Road School, Rosyth, and heating work at Crossgates new school. Schedules from Mr. R. H. Motion, architect, Union Bank Chambers, Dunfermline.

Halifax.—February 3rd. Electricity Department. Twelve months' supply of stores, including electric lighting fittings and accessories, cables, v.i.r., and phosphor bronze, telephone wire, e.h.p. and l.p. cables, meters, &c. (January 7th.)

Keighley.—January 24th. Corporation. Electricity Department. Construction of 6,600-V overhead line to Easeburn. (See this issue.)

London.—Hammersmith.—January 21st. Electricity Department. Three or more water-tube boilers capable of supplying 150,000 lb. of steam per hour. (January 7th.)

January 26th. Electricity Department. Single and three-phase transformers. (See this issue.)

Paddington.—January 24th. G.W.R. stores, including telegraph instruments, electrical apparatus, electric wire and cable, &c. (See this issue.)

L.C.C.—January 31st. Electric wiring installation at the Bethnal Green Weights and Measures Office and Coroner's Court, comprising about 87 switch points and 89 lighting points. (See this issue.)

Lurgan.—January 29th. Urban District Council. Four-core l.p. lead-covered and armoured cables. (See this issue.)

Manchester.—January 24th. Electricity Committee. Six motor-driven circulating-water pumps; three motor-driven boiler feed pumps and one motor-driven pump for weight-tank sump. (December 24th.)

Natal.—Durban.—January 26th. Corporation. Supply of telephone cable, paper sleeves, concrete pipes, and various telephone and miscellaneous accessories and materials.

February 16th. One 1,000-kW rotary converter with transformers and switchgear. Specifications of the above may be consulted on application to the Department of Overseas Trade, 35, Old Queen Street, E.C.

New Zealand.—Napier.—January 17th. Borough Council. One 500-kW electric generating set. Copies of the specifications and blue prints may be seen at the Department of Overseas Trade, 35, Old Queen Street, S.W.

WELLINGTON.—March 1st. Public Works Tender Board. Seven 4,000-kVA single-phase transformers, with accessories, for Lake Coleridge electric power scheme. Copy of the specifications can be seen up to January 20th at the Department of Overseas Trade, Room 48, 35, Old Queen Street, S.W. 1.

South Africa. — PRETORIA.—March 10th. Municipal Council. One 20-ton overhead crane, six boilers (350-lb. working pressure), three 3,000-kW steam turbo-generators with condensing plant, five 750-kW converters. Further particulars can be obtained from Mr. T. C. Wolley-Dod, general manager, electric lighting department. Specifications (five guineas) from the town clerk.

CLOSED.

Australia.—Sydney City Council. Recommended :—

Supply of four boilers and accessories, £253,356.—Babcock & Wilcox, Ltd.

The bulk of the plant to be manufactured in Sydney.

One 16,000-kW turbo-alternator, £168,000.

The contract provides for the manufacture of the plant in Sydney, as far as practicable.—*Tenders.*

Birkenhead. — Electricity Committee. The British Thomson-Houston Co., Ltd., for the supply and erection, &c., of high-pressure switchgear, for the sum of £4,003.

Bradford.—Tramways Committee :—

2,000 copper rail bonds at scheduled prices (approximately £316).—British Insulated and Helsby Cables, Ltd.
100 steel tramcar tires.—Anglo-Belgian Improvements Corporation.

Bury.—Corporation. Plant for Chamber Hall power station :—

Switchgear.—Ferguson, Pallin & Co., Ltd.
Ash removal plant.—Underfeed Stoker Co., Ltd.

Canterbury.—Town Council :—

Ferguson, Pallin & Co., Ltd.—Switchgear and cables, £2,495.
Hopkinson, Ltd.—Three 6-in. high-pressure valves, £103, plus 1s. 10d. per ft. for chains.

FORTHCOMING EVENTS.

Edinburgh Electrical Society.—Friday, January 14th. At the Philosophical Institute. At 8 p.m. Paper on "Some Notes on Cables," by Mr. W. F. Mitchell.

Electro-Harmonic Society.—Friday, January 14th. At the Cannon Street Hotel. At 8 p.m. Smoking concert.

Association of Engineers-in-Charge.—Saturday, January 15th. At St. Bride's Institute. At 7 p.m. Social and dance.

Manchester Association of Engineers.—Saturday, January 15th. At the Memorial Hall, Albert Square. At 7 p.m. Paper on "Reinforced Concrete and the Housing of Expensive Plant," by Mr. F. Milner.

National Association of Supervising Electricians.—Saturday, January 15th. At the Holborn Restaurant. At 6.30 p.m. Annual dinner.

Institution of Electrical Engineers.—Informal Meeting.—Monday, January 17th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Discussion on "The Mental Equipment of an Engineer." To be opened by Mr. P. Pitt.

Scottish Centre (Students' Section).—Friday, January 14th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "Alternating Current compared to Direct Current for Distribution and Supply," by Mr. R. R. Birch.

Liverpool Sub-Centre.—Monday, January 17th. At the University, Liverpool. At 7 p.m. Papers on "Electric Arc Welding applied to Aluminium," by Mr. F. J. Heyes; on "The Chemical and Metallurgical Aspects of Electric Arc Welding," by Mr. J. H. Paterson"; and on "The Cost of Electric Resistance Welding," by Mr. L. H. Wilson.

South-Midland Centre.—Friday, January 21st. Annual dinner.

(Students' Section).—Friday, January 21st. At Faraday House, Southampton Row, W.C.1. At 6.30 p.m. Paper on "Electric Welding," by Mr. S. J. Howard.

Royal Society of Arts.—Monday, January 17th. At 8 p.m. At John Street, Adelphi, W.C. Howard lecture, "Aero Engines." By Mr. A. E. L. Chorlton.

Wednesday, January 19th. At John Street, Adelphi. At 8 p.m. Paper on "The Future of Industrial Management," by Mr. F. M. Lawson.

Illuminating Engineering Society.—Tuesday, January 18th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Use and Abuse of Light in Studios for Kinema Film Production." To be opened by Mr. J. C. Envy.

Institute of Marine Engineers.—Tuesday, January 18th. At the Institute, The Minories, E. At 6.40 p.m. Paper on "The Internal Combustion Engine," by Mr. A. W. Bradbury and Mr. J. J. Fasola.

Manchester Wireless Society.—Wednesday, January 19th. At the Albion Hotel. At 7.30 p.m. Ordinary meeting.

Electrical Contractors' Association (Inc.).—Wednesday, January 19th. At the Connaught Rooms, Great Queen Street, W.C.2. At 7 p.m. Annual dinner.

Chelmsford Engineering Society.—Thursday, January 20th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Thermionic Valves," by Mr. C. H. Ford.

Chemical Society.—Thursday, January 20th. At Burlington House, Piccadilly, W.1. At 8 p.m. Ordinary meeting.

Institution of Mechanical Engineers.—Friday, January 21st. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "The Mechanical Loading of Ships," by Mr. H. J. Smith.

Junior Institution of Engineers.—Friday, January 21st. At the Caxton Hall, Westminster, S.W. At 8 p.m. Lecturette on "Motor Yachts," by Mr. B. H. Joy.

NOTES.

The Circulation of the "Electrical Review."—We notice that our business manager is publishing the certificate of the net sales of the ELECTRICAL REVIEW. This may be seen on p. xxvi. of the current issue.

The "Electrical Review" Index. — The Index to Vol. LXXXVII of the ELECTRICAL REVIEW, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 6d., post free. Any reader or advertiser, at home or abroad, who requires a copy for binding or for other purposes, is asked to make early application therefor to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

Appointments Vacant.—Instrument maker (£4 to £5) for the Dundee Technical College; electrician for the Holloway Sanatorium, Virginia Water; electrical draughtsman (£800) for an hydro-electric scheme in the Federated Malay States; lecturer in electrical engineering (£500) for the Auckland (N.Z.) University College; assistant mainsman, for the Bury St. Edmunds Corporation Electricity Department; consulting electrical engineer, for the Enniskillen Urban District Council; assistant divisional engineer ($360 per month + 20 per cent., dollar equal 2s. 4d.), for the Posts and Telegraph Department of the Government Straits Settlements; electrical engineering draughtsman (temporary) (£150 + £183), for the Metropolitan Asylums Board. See our advertisement pages to-day.

CORRECTION.—In our notice of the appointment vacant for an electrical draughtsman at the City and Guilds (Engineering) College, on page 852 of our issue of December 31st, the salary was quoted at £550; it should have been £350. The same error occurred in the official notice in our advertisement pages, and was due to the defective copy from which the matter was set up, three members of our staff who independently read the copy at the time arriving at the same result.

Electrically-Produced Lead.—The *Sydney Daily Telegraph* announces that at the lead sulphate works at Launceston, as a result of preliminary tests, the important discovery has been made that metallic lead can be produced from the sulphide (galena) by means of electricity, which has never previously been commercially demonstrated in the southern hemisphere. Under the direction of Mr. James Gitsham, managing director, this test was carried out with success. Pure lead was obtained, and within a short space of time. Up to the present the Lead Sulphate Co. has been forced to send all the dross to the mainland smelters for treatment, but now, with the electrical process, pure lead can be produced at the works.

"Bearing their Blushing Honours Full upon Them."—There is a hymn which says "Kind Words can Never Die," and when the kind words come from such a professedly unsentimental paper as the *Financial Times*, they deserve even an enhanced immortality—at least a deepened one if a lengthened one is impossible. In one of the issues of the *Financial Times* of last week they bewail sorrowfully the "fatal complacency" of employers (the immediate culprits are the Greater London Industrial Council), whom, they seem to think, might stray unsuspectingly into booby-traps, or other pitfalls for the innocent. However, it is not the theme we are concerned with, but the laudatory epithets bestowed on certain members of the Trade Unions, all the more gratifying, we are sure, because they are life-time tributes, and not epitaphs. The Trade Union representatives on the Greater London Council are (we feel the *Financial Times* bowing deprecatingly, like Mr. Arthur Balfour, as it says it), "Some of the most indefatigable and astute of their officers"—and this group contains (and here we feel Mr. Webb's modesty will cause him to blush), "the London District Secretary, to whom Lord Askwith gives a commendatory tribute in his recently-published 'Industrial Disputes.'" Talk about Birthday Honours! Anyhow, the *Financial Times* has set our friends something to live up to.

An Electrical Joint.—An electrical engineer, of Dudley, sends us the following order, written on the back of a butcher's bill form :—

Mr. Jennings
Please give bearer 1 ½ Watt lamb
and oblige
F. H——.

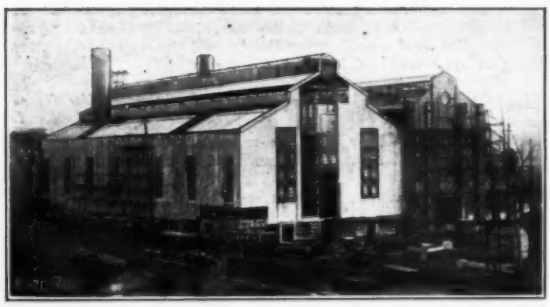
The ruling instinct appears to have guided the customer's pencil in this instance. Doubtless a grocer would spell "current" with an a, and an executioner would order a choking coil with professional appreciation.

The New Gas Regulations.—In accordance with the Gas Regulation Act, 1920, the Board of Trade has appointed Sir R. T. Glazebrook, K.C.B., F.R.S., to be Chief Gas Examiner, and Mr. C. V. Boys, F.R.S., Mr. J. S. Haldane, F.R.S., and Mr. W. J. Butterfield, F.I.C., F.C.S., to be Gas Referees. The Board has also appointed Mr. H. C. Honey to be Director of Gas Administration in the Power Transport and Economic Department, Board of Trade Offices, Great George Street, S.W. 1. Committees have been appointed to inquire whether it is necessary to prescribe any limitation of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes, or of the proportions of incombustible constituents which may be supplied in gas.

British Oil.—There was issued on January 5th, says the *Journal of Commerce*, a copy of the licence granted by the Minister of Munitions to Mr. Reginald Gilbey, of Nottingham, to search and bore for petroleum at Weston, Leicestershire. The licence is to continue in force for two years from October 8th, 1920, with the possibility of a renewal for two years. It is provided that boring must commence within six months of the date of the licence, and the licensee must indemnify the Minister of Munitions against all claims and demands arising directly or indirectly out of any of the operations. Payments by way of royalties, commission, profit, or otherwise, for the petroleum obtained are specifically forbidden. The licence also provides that if any Act of Parliament relating to petroleum within the United Kingdom be passed, the Minister shall have power to amend or vary the terms of licence as he shall think fit, but if these are not approved by the licensee he may surrender the licence.

Electricity Districts.—In our article on "The Electricity Districts" in our last issue, the capacity of the Sheffield power station is given as 68,700 kW. Mr. S. E. Fedden points out that that is the figure at which it stood in March last, but since that date the Blackburn Meadows station, with an additional capacity of 28,000 kW, has been put into commission, making the present total capacity of the undertaking 96,700 kW. Previous to March last the maximum load was 60,593 kW, and during the present winter it has been increased to 65,874 kW.

Blackburn Power Station.—The completion of the super-power station at Blackburn will open up a new industrial era for this locality. The new station, which is bounded on one side by the canal and on the other by the railway, is rapidly approaching the finishing stage. The cost will exceed three-quarters of a million pounds. The plant will be more extensive than originally proposed, owing to the co-operation of neighbouring authorities



THE NEW BLACKBURN POWER STATION.

and the general demand for the utilisation of power for industrial purposes. It is no secret that a number of cotton mills desire to install plant, and new undertakings are awaiting the provision of more power before embarking on their plans. At present the existing Blackburn station is overloaded, and the new service will provide necessary relief, not only in Blackburn, but in Harwood, Rishton, Darwin, &c. The above is an external view of the station.

Electrical Education.—New Zealand is alive to the importance of instructing consumers and prospective consumers in the use and advantages of electricity.

A series of lectures and demonstrations on electric power and lighting were arranged by Mr. J. P. Kalaugher, supervisor of manual training under the Education Board, at Paeroa, Te Aroha, Morrinsville, and Matamata. In reporting to the Board, Mr. Kalaugher said there had been a widespread request for instruction in the use of electricity in that area on account of power being available in the near future. The Thames Valley Power Board supplied the apparatus necessary for the lectures, and their cost was covered by the fees charged.

Mr. Kalaugher stated that it was the Board's function to arrange classes in any technical subject required. Electricity was coming to the Thames Valley, and it was going to revolutionise farming. Some 2,300 applications had been received for power. Those people wanted definite information about the possibilities of electric power. The lectures would serve a great public need.—*Auckland Weekly News.*

Transport of Refrigerated Produce.—For town distribution of refrigerated foodstuffs it is believed that the electric vehicle is the most suitable, assuming that power can be obtained at a reasonable price, although to obtain really good results with an electric vehicle it is necessary to use one of large carrying capacity. It is claimed that experience has shown that the running costs of a 3½-ton lorry are not more than 20 per cent. greater than those of a 1½-ton lorry. On the assumption that 40 miles per day are run for 250 working days per annum in town delivery by a lorry of which the first cost was £1,500, with electricity at 1·5d. per unit, the use of such a vehicle can be fully justified. Figures were submitted at a meeting of the Cold Storage Association showing that the operating costs with a 3-ton load would be 6d. per ton-mile. Making allowance for empty-car mileage and maintenance, the total costs would be 1s. 3d. per ton-mile gross.—*The Times Trade Supplement.*

Flat Electrode Welding.—A writer to the *Electrical World* points out that the use of flat electrodes in the place of the usual cylindrical type results in a great saving of time, and calls for considerably less skill upon the part of the operator. When operating upon a "V"-shaped opening, the flat electrode will assume a corresponding shape owing to the fact that the arc centres at those points closest to the metal, and thus melts off the electrode for a uniform distance. This relieves the operator of the task of skilfully moving the electrode from side to side, and down into the notch. When using this electrode, it is only necessary for the welder to carry one size, and to use it either flat or edgewise for wider or narrower seams. The flat electrode is also eminently fitted for automatic welding machines since it will give broad runs without side motion.

Electric Rivet Heating.—At a meeting of the Philadelphia section of the American Association of Iron and Steel Electrical Engineers, an official of the American Car and Foundry Co. stated that his firm used electricity for heating rivets in their passenger-car and freight-car departments, effecting a saving of between $1 and $2 per 100 lb. of rivets, as compared with oil heating. Over 100,000 rivets, weighing 45,700 lb. were treated daily. The amount of electricity consumed in this way averaged only about 14 kWh per 100 lb.

Determination of Protective Glass Opacity.—A quick method for determining the opacity of eye-protective glasses to ultra-violet rays has been worked out by the U.S. Bureau of Standards. The photographic method usually employed requires several hours for making such a test, while by the new method, which is radiometric, a test can be made in a few minutes. The test is based upon the fact that all glasses are opaque to radiations of wave lengths of less than 0·3 micron (1 micron = 1/1,000 mm.). It is, therefore, only necessary to examine eye-protective glasses for opacity to ultra-violet radiations of wave lengths of from 0·3 to 0·4 micron. Radiations of these wave lengths are easily obtained without employing a spectroscope by simply filtering the light from a quartz vapour lamp through a suitable glass screen placed over a vacuum thermopile. Measurements of one part in 10,000 are easily obtainable.—*Chemical and Metallurgical Engineering.*

A Cheap Transformer Installation.—A cheap form of customer's rural transformer installation is being supplied by the Miami Valley Electric Co., of Sidney, Ohio, says the *Electrical World*. The installation is simple and is easily installed. It consists of air-brake switches operated from the ground, horn-gap and resistance lightning arresters, choke coils, expulsion fuses and transformer. The approximate cost of a typical installation on a 13,200-V line to supply 110-220 V single-phase service is shown in the following list of materials and labour:—2½-kVA transformer, $135.00; switching equipment and lightning protection, $160.00; material for earthing neutral and lightning arrester, $2.50; one three-wire secondary rack, bolts, washers, and 300 ft. of No. 10 secondary, $5.00; labour, two men, four hours each at 50 cents per hour, $4.00; total, $106.50.

For the equipment installed complete with a three-wire secondary not exceeding 100 ft. (31 m.) in length a charge of $375 is made to the farmer. This covers overhead cost and the slight difference in construction cost in different installations.

Detection of Armature Short-Circuits.—To test for short circuits in motor coils outside the motor, a quick, reliable and at the same time inexpensive outfit was made by an *Electrical World* correspondent from an old pole piece of a synchronous motor. This pole piece measured about 7 in. long 4 in. wide and 6 in. high (18 cm. × 10 cm. × 15 cm.). A piece of fibre in the shape of the coil was attached to the yoke end of the pole to hold the winding, which consisted of five layers of No. 11 double-cotton-covered wire. Flexible leads were soldered to the ends of the winding. Current was taken from a 110-V alternating-current circuit.

In testing a coil it was placed over the pole piece. Any short circuit in the coil was detected first by a force trying to throw the coil off the core and, secondly, by the heat developed in the short-circuited turns. This outfit has very handy and many other uses may be found for it in the winding shop.

Electrical Bread-Baking.—The *Electrical World* gives details of a store in Salt Lake City where electricity has been substituted for raw fuel in the baking of bread. The supply company looks upon the oven as a very desirable business, as it is in steady use from five to sixteen hours each day, and maintains a fairly high load factor. The investment cost to obtain this business is little or no greater for smaller-size ovens than for the electric range, and the revenue is eight to ten times greater. In most cases no additional investment is necessary, as the load is connected in the commercial section, where feeders and transformers are of ample capacity to handle a greatly-increased load. The baking hours are so arranged by the class of work that the operation seldom overlaps a peak. If the oven is used during the day, it misses the morning peak and is turned off before the evening; if used during the night, it also misses both morning and evening peaks, thereby improving the load factor by filling in the valley of the load curve that is a problem to all central-station engineers.

An initial six-day trial proved this method of baking to be less expensive than the previous arrangement, and the success of the scheme was so marked that in Salt Lake City no less than 40 of these ovens are in daily use, in addition to 20 in other parts of the supply company's area.

INSTITUTION NOTES.

Birmingham and District Electric Club.—The club held its first meeting of the 1921 session on January 8th, when the president, Mr. A. C. Wynne, gave his presidential address, in which he dealt with the present position of the electrical profession and industry, and claimed that the time was more than ripe for those engaged in the business of electrical engineering to consider some means of setting and insisting upon a standard of fitness and efficiency, and thus form a means of protecting themselves and the public from the results of the ignorance and malpractices of those who ought never to be allowed to practise in a business of such supreme importance to the community as electrical engineering. The club meets on the second Saturday in each of the winter months at the Grand Hotel, Colmore Row, Birmingham, and electrical engineers residing in, or visiting the city, will always find a welcome, and, as a rule, an interesting and useful technical paper or discussion.

The arrangements for the first half session, 1921, include the following items:—February 12th, Mr. C. J. A. McDonald on "Reminiscences of the Test-bed"; March 12th, Mr. H. C. Young, on "Common-Sense Methods of Recording, Costing, and Progress in Shop Management"; April 9th, Mr. F. Forrest on "Supply of Electrical Energy in Birmingham and District"; March 4th, annual dinner.

Liverpool Engineering Society.—The annual dinner will be held at the Exchange Station Hotel, Liverpool, on Thursday, January 27th, at 7 p.m.

Institution of Electrical Engineers.—The following programme of Informal Meetings has been arranged for January:—17th, "The Mental Equipment of an Engineer," by Mr. P. Pitt; 24th, discussion on "Improving the Usefulness of the Institution," Mr. Ll. B. Atkinson (president) in the chair; 31st, "Possible Economies in Housewiring," by Mr. L. Milne. The second annual smoking concert is to be held on February 28th.

Chelmsford Engineering Society.—On January 6th, at the East Anglian Institute of Agriculture, Mr. Thomas Clarkson delivered an instructive lecture on "Motor Transport Economics," outlining the growth of road transport from the pioneer work of the early French engineers up to the present day. He pointed out that by the use of coke as fuel in a steam-driven lorry, it was now possible to carry a three-ton load at a net cost of 1½d. per mile. In the discussion that followed, Mr. C. Johnson pointed out the advantages of electric transport for a short and intermittent haul.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. W. B. BRASSINGTON, formerly chief engineer of the Motherwell electric undertaking, has been appointed chief engineer of the joint undertakings of Motherwell and Wishaw, which will in future be controlled as one unit; MR. DAVID B. SCOTT, Wishaw, has been appointed mains superintendent of the joint undertakings.

The Röntgen Society has made the first award of the Mackenzie Davidson medal to DR. F. W. ASTON, for a paper on "Positive Rays."

MR. HUBERT M. FREEMAN, associate physicist of the radio section, Bureau of Standards, U.S.A., has resigned to accept a position with the Westinghouse Electric and Manufacturing Co. —*Science.*

Hackney Borough Council Establishment and General Purposes Committee recommends that MR. J. G. W. CLEMENTS be appointed sales department salesman in the electricity department at a commencing salary of £220 per annum.

The marriage has taken place at Edinburgh of MR. COLIN RUSSELL, A.M.I.E.E., who gained the M.S.M. whilst serving with the Royal Engineers, and Miss Frances Brown, of Edinburgh.

MR. H. F. REEMAN, who, for a number of years, has been power station superintendent to the Llanelly and District Electric Lighting and Traction Co., Ltd., resigned on 31st ult., to take up a position as manager to a manufacturing firm in Lancashire. On leaving he was presented with a gold watch by the members of the staff.

Barrow Town Council has been recommended to increase the salary of the electrical engineer to £950 per annum as from April 1st, 1920, or any variation thereof which may be agreed upon between the Standing Sub-Committee of the Council and the A.M.E.E.

Will.—The late MR. J. STUBBS, O.B.E., director of the Concordia Electric Wire Co., Ltd., left £36,760 gross, and £29,151 net personalty.

Portsmouth Leader Cable.—Representatives of nearly every Navy in the world witnessed a demonstration at Portsmouth, on the 4th inst., of the electric "leader cable," which was installed some time ago, and by means of which ships can be guided into port in foggy weather, or when the ordinary navigation marks are not visible.

JOINT ELECTRICITY AUTHORITIES.

WEST OF ENGLAND DISTRICT INQUIRY.

An inquiry into the proposed formation of a Joint Electricity Authority as provided for by the Electricity (Supply) Act, 1919, was opened at Bristol on January 11th, in connection with the Lower Severn District. Sir John Snell, Sir Harry Haward, Mr. H. Booth and Mr. Archibald Page represented the Electricity Commissioners, who were accompanied by their legal adviser, Mr. E. W. Hudson, and their clerk, Mr. D. S. Cumberlege.

County Councils, Borough, Urban District, Rural District, and Town Councils were represented by their legal advisers at the inquiry, and many "electrical" gentlemen were present, including Mr. Roger T. Smith, who in company with Mr. Tyldesley Jones represented the Great Western and Midland Railway Companies, Messrs. H. Faraday Proctor (Bristol), F. Teague (Bath), W. J. Bache (Cheltenham), F. H. Corson (Gloucester), F. Newey (Swindon), W. T. Kerr (Hereford), H. I. Munro (Exeter), C. G. Morley New (Cardiff), S. T. Allen (Wolverhampton), W. Nairn (Bristol Tramways Co.), W. Hardey (Bath Tramways Co.), G. Charlton (Weston-super-Mare Electric Supply Co.), G. L. Coventon (Chepstow E.L. Co.), H. Walker (Bridgwater E.L. Co.), F. Christy (North Somerset Supply Co.), C. T. Allan (South Wales Power Co.), J. H. Edwards (various undertakings), W. L. Madgen (British Electrical Federation), J. W. Burr (Swansea and South Wales Linking-up Committee), T. W. Cole (Provincial Electricity Supply Committee), and Mr. Arthur Ellis, consulting engineer, Cardiff.

In opening, Sir John Snell read the notice convening the inquiry, which stated that any body or person interested might attend the inquiry either personally or by counsel, solicitor, or agent. He mentioned that the present Electricity Acts did not confer any financial powers upon Joint Electricity Authorities, but the Bill which was to be laid before Parliament next session would contain the financial powers necessary to a Joint Authority to borrow money and to issue electricity stock, and powers to local authorities, companies, and persons, to render financial assistance to a Joint Electricity Authority by loans, by guarantee of interest or otherwise. The procedure of the inquiry would be to call upon the chairman of the Organising Committee (Mr. H. Faraday Proctor), which has submitted the scheme to open, and thereafter such witnesses as might appear in support of the scheme would be examined and cross-examined by counsel or solicitors appearing for the various interests in such order as they might arrange between themselves. He had expected that the Organising Committee would have been represented by counsel, but Mr. Proctor as the chairman of the Organising Committee, would present the case on behalf of the Organising Committee, and then would have to put himself into the box as a witness to be cross-examined by those representing the other interests, a not altogether helpful way of doing things, which might lead to some confusion. He was rather sorry for Mr. Proctor, because he had to appear in a dual capacity. Sir John pointed out some inaccuracies in the notice of provisional determination of the first district. He then called upon Mr. Proctor to explain the proposals for the scheme.

Mr. H. Faraday Proctor, in opening his case, detailed the two or three references which had led up to the present stage in the proceedings. General particulars and financial estimates had been prepared and had been submitted to the Commissioners, with the request for the putting in hand of those interim works and estimates more particularly referring to the Beachley generating station in the Forest of Dean. Additional information was furnished to the Commissioners as desired, embracing general statistics and an outline of a scheme showing the feasibility of transmitting energy to various localities in the south-eastern portion of the district on a sound financial basis. These details had not been submitted to other authorities in the proposed districts. The scheme submitted dealt particularly with the constitution of the Joint Authority and the method of securing proportionate representation and the basis of the same. It was deemed to be a *sine qua non* that those bodies or companies which through their representatives were entrusted with the control and direction of the affairs of the authority, including its finances, should be responsible for its solvency. It had been, and was, considered undesirable, and indeed impracticable, for a committee which was not regularly constituted and had not time or means at its disposal to undertake the specific detailed investigation of the engineering problems, more particularly having regard to the fact that the area had not been determined.

Sir John Snell inquired how it came about that the district was in that position, when to the knowledge of the Commissioners other districts which had submitted schemes had submitted the full engineering particulars. He stated that corporations and companies could not possibly criticise the proposals of the Organising Committee unless those particulars were put at their disposal. They ought to have something concrete to go upon. He was disappointed that the Organising Committee had not the information which had been submitted to the Commissioners available for distribution to the various representatives present. It was a little unfair to those representatives not to have the particulars in their hands.

The point raised by Sir John was endorsed by many of those

present, and after a conference with his colleagues, the inquiry was adjourned until March 1st, by which date it was hoped that all available information, both technical and otherwise, would be furnished to the various parties interested.

Before adjourning, Sir John stated that the idea to be borne in mind was the improvement of the supply of electricity in the district and its gradual evolution and development. Interests ought to be, on main principles, common. In fairness to Mr. Proctor, he ought to state that he did not blame him or the Organising Committee for the position they found themselves in that morning. The Organising Committee had, after all, taken the initiative in this matter. As this was the first inquiry of its kind, without any settled form of procedure, they would gradually have to formulate as they went along. A certain amount of preliminary work and loss of time was inevitable, but he supposed other districts would benefit at the expense of the Lower Severn.

The sudden postponement of the inquiry was entirely unexpected by the electrical industry, which had looked forward to the investigation with keen interest. It appears that the Organising Committee was hardly prepared for the array of consulting engineers and learned counsel with which it was confronted, and Mr. H. Faraday Proctor—to whose indefatigable labours the Lower Severn District is deeply indebted—found himself in an unenviable position. We gather that the presentation of a technical scheme is regarded by the Electricity Commissioners as an indispensable feature of such an inquiry, and it so happens that of the four proposals which have been published, the Lower Severn Scheme is the only one in which it is lacking. If this procedure is to become standardised, it will obviously be difficult or even impossible to form a Joint Authority for the purpose of exercising supervision over a District without actually engaging in electricity supply.

The postponement of the inquiry is not altogether to be regretted; it will afford an opportunity for the interests concerned to confer with a view to submitting to the Commissioners an agreed and well-thought-out technical scheme, from which contentious elements will have to be eliminated as far as possible, and the incident will serve for the guidance of other organising committees in the preparation of their cases. We understand that the Bath City Council, which was formerly disposed to stand aloof, has assumed a more friendly attitude with regard to the proposals; as a measure of justice, we must point out that in the early stages the Bath representatives insisted on the preparation of a technical scheme as a condition precedent to their adhesion, and to the formation of a Joint Authority for the District.

NEW COMPANIES REGISTERED.

Smith & Ansell, Ltd. (172,491.)—Private company. Registered January 7th. Capital, £7,000 in £1 shares. To take over the business of manufacturers of electric light fittings, &c., carried on by H. S. Smith and B. Ansell at 109, Great Hampton Row, Birmingham, as "Smith & Ansell." The first directors are: H. S. Smith, "Vron," Maney Hill Road, Sutton Coldfield (chairman); B. Ansell, 280, Kingsbury Road, Erdington, Birmingham. Registered office: 109, Great Hampton Row, Birmingham.

Ennis Gas & Electric Supply Co., Ltd. (5,094).—Registered in Dublin January 3rd. Capital, £5,000 in £1 shares. To supply electric light to the town of Ennis. The first directors are: A. Knox, merchant, Ennis; J. O'Dea, merchant, Ennis; J. Brevin, merchant, Ennis; P. Cahn, merchant, Ennis; D. McInerney, merchant, Ennis; M. McInerney, merchant, Ennis; M. McMahon, merchant, Ennis. Solicitor: F. T. Cullinan, 8, Nassau Street, Dublin.

Haslam & Stretton (Engineering and Motor Utilities), Ltd. (172,459).—Private company. Registered January 6th. Capital, £25,000 in £1 shares. To take over the mechanical, electrical, and motor utilities supply business of Haslam & Stretton, Ltd. The first directors are: S. B. Haslam, 11, Windsor Place, Cardiff, engineer; T. Stretton, 11, Windsor Place, Cardiff, engineer; W. Falcon, no address given; G. H. Ockwell, no address given. Registered office: 11, Windsor Place, Cardiff.

Scholey Construction Co., Ltd. (172,385).—Private company. Registered January 1st. Capital, £30,000 in £1 shares. To adopt an agreement with H. Scholey, C.B.E., for the transfer of certain property and rights to use a process relating to an improved method of treating rails, &c., with apparatus for heat treatment "in situ," and to carry on the business of manufacturers of railway and tramway apparatus, rolling stock, engines, and machinery of all kinds, &c. The subscribers (each with one share) are: F. S. Clark, 11, Pancras Lane, E.C. 4, solicitor; E. W. Brett, 25, Kelsey Park Road, Beckenham, Kent, solicitor's clerk. The first directors are: H. Scholey, C.B.E., Rt. Hon. G. H. Roberts, M.P., C. W. Hill, and E. S. Ormsby. The last named shall be entitled to act without qualification. In the event of the said E. S. Ormsby ceasing to act as director, C. P. Sandberg, of 40, Grosvenor Gardens, S.W., shall be entitled to nominate a director in his place during the continuance of the "principal agreement." Solicitor: F. S. Clark, 11, Pancras Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

North Metropolitan Electrical Power Distribution Co., Ltd.—Particulars of £40,000 debentures (of which £25,000 has already been registered) authorised by resolutions of June 17th, 1909, May 6th, 1915, and November 9th, 1920, present issue £15,000, charged on the company's undertaking and property, present and future, including uncalled capital.

Airedale Electrical & Manufacturing Co., Ltd.—Mortgage dated December 18th, 1920, to secure £600, charged on land in or near Ryan Street, Bowling, Bradford, and garage shed, &c., thereon. Holders: S. E. Jackson, 32, Ryan Street, Bradford, and W. B. Lund, 8, Beechwood Grove, Undercliffe, Bradford.

Douglas Engineering Co., Ltd.—Two mortgage debentures dated December 7th, 1920, to secure £3,000 and £1,000 respectively, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: R. J. Corporation, Ltd., 370, High Road, Willesden Green, N.W.

City of Oxford Electric Tramways, Ltd.—Satisfaction to the extent of £1,600 on December 17th, 1920, of charge dated February 20th, 1914, securing £46,000.

Wilson-Wolf Engineering Co., Ltd.—Satisfaction in full on November 28th of mortgage dated March 22nd, 1920, securing all moneys due or to become due, not exceeding £3,000 notified. Also mortgage dated December 30th, 1920, to secure all moneys due or to become due from company to London Joint City & Midland Bank, Ltd., charged on certain freehold hereditaments in Towler Street, Peterborough.

Phonopore Construction Co., Ltd.—Particulars of £5,000 debentures authorised by resolutions of November 15th and December 14th, 1920, whole amount issued, charged on the company's undertaking and property, present and future, including uncalled capital.

Wakelins, Ltd.—Satisfaction to the extent of £1,380 on December 15th, 1920, of debentures dated July 10th, 1919, securing £1,480.

CITY NOTES.

Adelaide Electric Supply Co., Ltd.

From the *Adelaide Register* of November 10th, just to hand, we learn that a meeting of local shareholders was held in Adelaide on November 9th, when Sir Geo. Brookman, the chairman of the local board, who has recently visited England in connection with the question of the transfer of the head office from London to Adelaide, and the heavy burden imposed upon the company by the payment of British income tax as well as local taxation, explained the result of his investigations. Sir Geo. Brookman said shareholders were aware that for some time the directors in London and in Adelaide had endeavoured to secure relief from double taxation. For some years an abatement had been made, and they had hoped that it would be increased and further concessions granted to Australian shareholders. Previously to his visit to London Mr. J. K. Samuel discussed with the board the subject of moving the head office to Adelaide to avoid British taxation on amounts earned and distributed in Australia, and negotiations on that point were continued on his arrival. While the steps were in progress matters were brought to a crisis by the imposition of the company tax of 5 per cent., and the adamant attitude of the Chancellor of the Exchequer on the subject of further relief. The situation had been discussed with the London board from all points, and it was found that to avoid the tax it would be necessary to move the control of the company to Adelaide. Fortunately, it would make no difference, as the company had been practically managed in Adelaide for many years, with the London board settling matters of policy and materially assisting in matters of finance. It had been agreed by the London directors that after March, 1921, the company should be controlled from South Australia. He was pleased to say that the arrangement for the transfer was of a friendly nature, the directors recognising that the tax was unfair, and he asked shareholders to support the payment of £7,000 as compensation for the loss of office. A saving of £12,000 a year would be made immediately, and larger sums as the business expanded. Should the resolutions to be submitted be approved by local shareholders, a meeting would be held in London on January 19th, at which they would be submitted to the English shareholders, who numbered more than 600, and held about 300,000 shares, and he did not expect any opposition from them, as they would indirectly benefit by the savings to the company. Arrangements had been made to continue the office in London. They had a capable secretary, who was also an engineer, and also had the services of Kincaid and Co., the eminent consulting engineers. The interests of the company had been safeguarded in every respect, and they would still retain the sympathy of the London directors.

The following resolution was carried: "That this meeting of local shareholders in the Adelaide Electric Supply Co. approves the terms proposed for the transfer of the control of the company to Adelaide as set out in the notice to the meeting to be held in London on January 19th embodying the resolution to be submitted there."

It was also agreed that the London directors should be paid £7,000 as compensation for loss of office.

The draft notice set out that on and after March 1st the board of directors in Adelaide would consist of Sir George Brookman, Hon. D. J. Gordon, M.L.C., and Messrs. J. K. Samuel and F. W. Clements.

It was also stated that the directors intended shortly to issue the remainder of the ordinary shares, as more capital was required.

Gross revenue for the year ended August 31st, 1920, £238,763, as compared with £185,907 for the previous year. After deducting management and general expenses in Adelaide and London and providing for interest and sinking fund on 5 per cent. debenture stock and interest on 6 per cent. consolidated debenture stock, writing off the cost of issue of "A" preference shares £4,000, placing to reserve for income tax and corporation tax £5,000, to general reserve £5,000, and paying a final dividend of 7 per cent. (actual) on 350,000 ordinary shares, making 12 per cent. free of British tax for the year, there is a balance of £2,103, and £18,360 brought forward to be carried to next account. Capital expenditure to August 31st, 1919,

amounted to £1,047,683, plus further expenditure during the year £133,400, making £1,181,083, less £22,481 written off, leaving balance of capital expenditure £1,158,602.

The Compagnie Générale d'Electricité.

The report of the directors of the Compagnie Générale d'Electricité, dealing with the year 1919-20, states that the activity of the manufacturing works on the whole was only limited by the scarcity of coal and the irregularity in the transport services. The work of extension or transformation of the means of production was continued. The Pont-en-Royans factory for the manufacture of small electrical apparatus was set in operation in March, 1919, and a second works was on the point of being finished at Saint Marcellin, in order to supplement the former. In the case of the Orleans electrical and mechanical works, the production of motors and transformers in bulk was beginning. The Tubes de Vincey, which works had been in use since February, 1919, had been converted into a separate company with a share capital of 30,000,000 fr., in the formation of which the Campagnie Générale had participated with the Aciéries de la Marine; and the interests taken by the company in the Aciéries et Usines à Tubes de la Sarre had been transferred to the Société des Tubes de Vincey. Proceeding to refer to subsidiary companies, the report mentions that the Ateliers de Constructions Electriques de Delle, which made a speciality of high tension apparatus, had distributed a dividend of 6 per cent. for the past year, and the same rate had been paid by the Compagnie Générale d'Electro-Ceramique. As to the question of the supply companies which were in a serious situation, the report recalls the fact that the Ministry for Public Works had recommended the introduction, in the fixing of sale prices for energy, of an economic index, taking into account variations in the prices for coal and the cost of labour. Certain agreements, some of which were provisional and others were definite, had been arranged on this basis between the concessionnaire companies and the municipal authorities which granted the concessions. It, therefore, seemed that in the course of time the company's subsidiaries would again enter upon a period of normal financial yield. The accounts showed net profits of 7,370,000 fr., or an increase of 885,000 fr. over 1918-19, and a dividend has been declared at the rate of 60 fr. per share, as contrasted with 50 fr. in the preceding year.

M. Azaria, deputy manager, addressed the shareholders at considerable length at the recent general meeting, discussing in particular the crisis which places a heavy burden on everyone at the present time. After giving details, he expressed the opinion that every manufacturing or merchant undertaking should keep a special account to equalise the difference between the real profits resulting from the exercise of trade and the temporary profits derived, without working, from the rise in value of stocks. The crisis was world wide, and the company was impeded by the competition of other producing countries which also sought foreign markets in order to dispose of the products which their inland markets were unable to absorb. As to the question when the crisis would come to an end, the speaker remarked that reassuring indications were beginning to appear; they would no doubt require several months to exercise their full effect.

After referring to the fall in the prices for coal, the deputy manager approached the question of labour. He stated that the mentality of the workman was visibly being transformed; the workman was ceasing to follow those who advised him more and more to restrict his production, and the individual efficiency was increasing in all the company's works. The number of workmen employed by the company and its subsidiaries was 13,682 on June 30th, 1920; and had risen to 14,389 by the end of November. In conclusion, the speaker announced that applications for prices were now being made to an extent which had not been known for many weeks past, and it was possible that purchasers were beginning to ask themselves whether the time was not at hand when it would be right for them to buy.

German Companies.

The directors of the *Fabrik Isolierter Drahte vorm. C. J. Vogel*, of Berlin, recommended a dividend and bonus at the rate of 35 per cent. for 1919-20, as compared with 18 per cent. in the preceding year. It is proposed to increase the share capital by 11,500,000 to 23,000,000 marks.

The accounts of the *Elektrowerke A.G.*, of Berlin, whose shares are held by the State, show net profits of 349,000 marks on an ordinary capital of 5,000,000 marks. The company, which supplies power to the State nitrogen works at Piesteritz, and also contributes towards the delivery of energy in Berlin, has a State loan of 55,480,000 marks.

The accounts of the *Electrizitats A.G., vorm. Herman Poege*, of Chemnitz, show net profits of 2,514,000 marks for 1919-20, this result contrasting with 1,139,000 marks in the previous year. A dividend has been declared at the rate of 17 per cent., as in 1918-19, and the share capital is to be increased from 22 to 42 millions of marks. The directors state that the stock of orders and degree of activity in the new financial year are satisfactory, and the restrictions in working in certain departments have been mostly discontinued.

The report of the *A.G. fur Elektrizitats Anlagen*, of Berlin, states that allocations to the reserve fund were made in 1919-20 to meet the threatened losses on the works in Konitz and Thorn, which are situated in the district ceded to Poland. Two German supply works were disposed of, as also were the shares held in Russian undertakings. The accounts show net profits of 650,000 marks, as compared with 533,000 marks in 1918-19, and the dividend is at the rate of 6 per cent. on share capital of 10,000,000 marks, as contrasted with 5 per cent. in the preceding year.

Dublin United Tramways Co., Ltd.—The directors have decided to place £30,000 to the track renewals fund, £2,000 to depreciation on investments, to pay the following dividends, less tax, for the half-year ended December 31st, 1920: 6 per cent. on the preference stock and 7 per cent. on the ordinary stock, making 5¼ per cent. per annum, carrying forward £13,331.

Anglo-American Telegraph Co., Ltd.—Balance dividends of 1¼ per cent. on ordinary consolidated and preferred stocks, and first and final dividend of 1¼ per cent. on deferred stock for the year, all less tax, making 3¾ per cent. on ordinary consolidated, 6 per cent. on preferred, and 1¼ per cent. on deferred stock for 1920.

STOCKS AND SHARES.

TUESDAY EVENING.

THE course of Stock Exchange markets is not running quite so smoothly as it did last week. There has been something of a halt in the public demand for most of the active securities, and the talk of cheaper money in the near future has not sufficed to prevent a pretty general setback in active issues. The main reason for the decline is simply that there is not enough business to counteract the usual amount of selling which goes on automatically day by day. Moreover, the buoyancy of last week failed to take fully into account the various elements that make for difficulty in trade conditions to-day: unemployment, high costs, foreign exchanges and the other items in the catalogue of causes that weigh upon industry all round. Home Railway stocks, which were quite a good market last week, have mostly eased off on the latest crop of doubts as to whether the companies are, or are not, paying their way.

In the general protest which has arisen against the proposed increase to be levied upon telephone-users, the Stock Exchange has played its part with other members of the community. Numerously signed petitions have been presented to the Stock Exchange Committee asking that body to take steps to lay before the Government the severe handicap which the suggested increases in rates would lay upon fluidity of markets, thereby causing a loss to the public and to the revenue. The Stock Exchange recognises, of course, that the telephone service cannot be run indefinitely at a heavy loss to the country, but there is a distinct inclination to ask whether such reforms of management cannot be introduced into the existing system as would enable the rates to be substantially less, at all events, than those which it is now proposed to inaugurate.

Underground Electric income bonds retain a rise of 2 points on the week, and the shilling shares are firmer at 5s. 6d., the market in Tube stocks not being affected by the heaviness that has overtaken various issues in the steam group.

We referred last week to the intention of the County of London Electric Supply Company to apply for parliamentary powers for the establishment of a separate concern to deal with its Barking undertaking. It is reasonable to suppose that after the necessary amount of official red tape has been cut, the scheme will be duly passed. Some speculation has arisen in the market as to what will be the result, and if a guess may be hazarded in this column, we would say that the lines of the plan may follow those which prevail in the case of the Charing Cross and City Company. No change has occurred in the price of the ordinary, but the preference are 5s. lower. To give some idea of the way in which cheap shares are coming to market, we may mention that a small parcel of Chelsea 6 per cent. preference changed hands the other day at 2 9/16. As the shares are of the nominal denomination of £5, this gives a return on the money of nearly 12 per cent., and although there is not much market in the shares, the company is one of the soundest in the group. Metropolitan, Westminsters, and Charing Cross ordinary are all ¼ up on the week.

Edisons, after their dip to 8s. 9d., have recovered to 12s. 6d. There are interesting rumours current in the market with reference to a closer association of this company with one of the other big electrical undertakings, but no definite information is at present forthcoming. Electric Constructions have risen to 17s. 6d.; General Electrics are unchanged.

The Eastern cable group is quotably strengthened with rises in Eastern Extensions, Globe ordinary, Eastern ordinary and Western shares. Moreover, the new stocks of these companies are all better than they were. The cheapest in the list is Western new, which stand at 14¼ as against the old shares at 14¼. Siemens new shares eased off to 8s. 9d., and Henleys at 30s. are ¼ down. Otherwise there is not much change in the manufacturing market. The British Columbia Electric Rail-

way has declared a dividend on the preferred ordinary of 23s. per cent., free of tax, making £4 13s. for the year, with a dividend of £2 14s. on the deferred, free of tax, making £6 4s. for the year. The deferred stock is 2 points higher, the preferred being a point down, which is certainly surprising in view of the excellent figures. Foreign railways, however, are somewhat out of favour. Brazil Tractions are 1 up at 38, Mexicans are mostly easier, and some dozens of falls have occurred in the lists of dollar securities, owing to the rise in the value of the £ sterling. Amongst the falls which have taken place in these stocks are many concerned with American and Canadian industrials.

Marconis at 2¼ show 1/16 decline, in spite of the new public telegraph service (conducted by the Marconi Company and the Compagnie Générale de Telegraphie sans fil) which opened last Saturday with an exchange of greetings between King George and the French President. It is stated, by the way, that a wild outburst of speculation in industrials has broken out on the Berlin Bourse, and that large schemes are projected, having for their object the amalgamation of various German electrical companies, several of which were well known in this country before the war.

Rubber shares have come down after their improvements. The burst of buying which carried up prices so sharply last week was succeeded by a fair amount of selling on the part of those who have been anxious to get out of their rubber shares for some time past, and a contribution to the fall was afforded by rubber itself going back from 16d. to 13d. per lb. Iron, steel and armament shares, however, keep firm, Vickers further improving to 17s. 9d., while Babcock & Wilcox are better at 2½. The provinces are buying their particular favourites in this group, the market for which is one of the firmest round the Stock Exchange.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Jan. 11, 1921.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary..	8	12	8⅞	—	£10 4 4
Charing Cross Ordinary	4	7	2½	+ ⅛	10 0 0
do. do. do. 4½ Pref. ..	4½	4½	2⅝	—	8 3 8
Chelsea..	3	4	3½	—	6 8 0
City of London	8	10	1⅞	— ⅛	9 8 2
do. do. 6 per cent. Pref. ..	6	6	17/6	—	6 17 2
County of London	7	8	7½	—	10 13 4
do. do. 6 per cent. Pref.	6	6	7⅞	- ½	7 15 0
Kensington Ordinary	6	7	8½	—	9 0 6
London Electric	Nil	2½	1	—	10 0 0
do. do. 6 per cent. Pref...	6	6	2⅝	—	10 18 2
Metropolitan..	5	6	2⅞	+ ⅛	10 18 2
do. 4½ per cent. Pref. ..	4½	4½	2¼xd	—	8 15 8
St. James' and Pall Mall	10	12	6½	—	9 12 0
South London	5	6	2½	—	9 12 0
South Metropolitan Pref.	7	7	18/9	—	10 3 8
Westminster Ordinary	8	10	4⅞	— ⅛	10 5 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	75½	—	7 19 0
do. Def.	33/6	1½	16⅜	+ ⅛	9 14 6
Chile Telephone	5	6	5½	—	*5 9 1
Cuba Sub. Ord.	7	7	6⅞	— ⅛	10 0 0
Eastern Extension	8	10	15	+ ½	*6 18 4
Eastern Tel. Ord.	8	10	15½	+ ½	*6 9 5
Globe Tel. and T. Ord.	8	10	15	+ ½	6 13 4
do. do. Pref.	6	6	8½	—	7 1 2
Great Northern Tel.	22	22	20	—	11 0 0
Indo-European	18	10	80	—	8 6 8
Marconi	25	25	2¼	— ⅛	—
Oriental Telephone Ord.	10	12	2⅛	—	*5 4 0
United R. Plate Tel.	8	8	5½	—	*6 16 4
West India and Panama	1/8	Nil	⅛	—	Nil
Western Telegraph..	8	10	14⅛	+ ⅛	*6 11 7
HOME RAILS.					
Central London Ord. Assented ..	4	4	43½	—	9 4 6
Mesropolitan	1	1½	30	—	6 5 0
do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅞	—	Nil
do. do. "A" ..	Nil	Nil	5/6	+6d.	Nil
do. do. Income ..	3	4	69½	+2	—
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref. ..	Nil	5½	22 xd	—	10 0 0
do. do. 2nd Pref. ..	Nil	Nil	8½	—	Nil
do. do. 5 % Deb. ..	5	5	54½	+1	9 3 6
Brazil Tractions	Nil	Nil	38	+1	Nil
British Columbia Elec. Ry. Pfce.	5	5	56	-	8 18 4
do. do. Preferred	2½	5	54½	−1	*8 9 9
do. do. Deferred	Nil	5	51½	+2	*11 8 4
do. do. Deb. ..	4½	4½	64½	+1	7 16 0
Mexico Trams 5 per cent. Bonds..	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	2½	−1	Nil
Mexican Light Common	Nil	Nil	12½	- 3½	Nil
do. Pref.	Nil	Nil	23½	—	Nil
do. 1st Bonds	Nil	Nil	60½	−1	Nil
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	92	+ ½	6 6 4
British Aluminium Ord.	10	10	4	—	11 8 6
British Insulated Ord.	12½	15	13	—	10 18 2
Callenders	25	15	13	—	10 18 2
,, 6½ Pref.	6½	6½	17/6	—	7 8 7
Castner-Kellner	20	17	23	—	7 2 9
Crompton Ord.	10	10	16/6	—	12 2 6
Edison-Swan	10	10	13/6	+ ⅛	—
do. do. 5 per cent. Deb. ..	5	5	70xd	—	7 2 10
Electric Construction	10	10	7/3	+1/-	11 8 6
Gen. Elec. Pref.	6½	6½	17/6xd	—	7 10 9
do. Ord.	10	10	1⅝	—	*8 8 5
Henley	25	15	1⅝	— ⅛	10 0 0
do. 4½ Pref..	4½	4½	8½	—	7 4 0
India-Rubber	10	10	⅜	—	—
Met.-Vickers Pref.	—	8	11½	—	9 9 4
Siemens Ord...	10	10	1⅛	—	*9 14 2
Telegraph Con.	20	20	21	—	*5 14 8

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, January 11th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per lb.	1/5	5d. dec.
a Ammoniac Sal ... ... per ton	£110	...
a Ammonia, Muriate (large crystal) ,,	£92	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£38	£3 dec.
a Copper Sulphate ... ... ,,	£40	£3 dec.
a Potash, Chlorate ... ... per lb.	8d.	4d. dec.
a ,, Perchlorate ... ... ,,	1/3	1d. dec.
a Shellac ... ... per cwt.	£20	£3 dec.
a Sulphate of Magnesia ... ... per ton	£18	...
a Sulphur, Sublimed Flowers ... ,,	£23	£1 dec.
a ,, Lump ... ... ,,	£18	£1 dec.
a Soda, Chlorate ... ... per lb.	6d.	...
a ,, Crystals ... ... per ton	£8	£1 dec.
a Sodium Bichromate, casks ... per lb.	1/-	...
METALS, &c.		
p Babbitt's Metal Ingots ... ... per ton	£95 to £300	...
c Brass (rolled metal ½" to 12" basis) per lb.	1/1½	...
c ,, Tubes (solid drawn)... ... ,,	1/1½ to 1/3½	½d. dec.
c ,, Wire, basis ... ... ,,	1/1⅛	...
c Copper Tubes (solid drawn) ... ,,	1/5½	½d. dec.
c ,, Bars (best selected) ... per ton	£130	£2 dec.
c ,, Sheet ... ... ,,	£130	£2 dec.
c ,, Rod ... ... ,,	£130	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£83 10	10/- dec.
d ,, ,, Sheets ... ,,	£143	...
d ,, ,, Wire Rods.. ,,	£99 10	10/- dec.
d ,, ,, H.C. Wire .. per lb.	1/0	½d. dec.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
n German Silver Wire ... ... ,,	2/9	3d. dec.
h Gutta-percha, fine ... ... ,,	14/- to 16/-	...
h India-rubber, Para fine ... ... ,,	1/1½	1½d. dec.
i Iron Pig (Cleveland Warrants) ... per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£54	...
g Lead, English Pig ... ... ,,	£26	30/- inc.
g Mercury ... ... per bot.	£13 10 to £12 15	30/- dec.
c Mica (in original cases) small ... per lb.	6d. to 4/6	...
e ,, ,, ,, medium .. ,,	5/- to 10/-	...
e ,, ,, ,, large ... ,,	12/6 to 25/- & up	...
p Phosphor Bronze, plain castings ,,	1/6 to 1/11	...
p ,, ,, rolled bars and rods ,,	2/5 to 2/8	...
p ,, ,, rolled strip & sheet ,,	2/5 to 2/9	...
d Silicium Bronze Wire ... ... per lb.	1/10	...
r Steel, Magnet, in bars ... ... ,,	1/8	...
n Tin, Block (English) ... ... per ton	£302	£6 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/3	6d. dec.
p White Anti-friction Metals ... per ton	£78 to £300	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
p
r W. F. Dennis & Co.

America's Industrial Situation.—The Federal Reserve Board's monthly statement reviewing business and financial conditions says :—"Further progress in business readjustment has been the characteristic feature of commercial and industrial development during December. The readjustment has been accompanied by a further decline in prices, bringing the Board's index number to 198 per cent. of the 1913 level, the month's decline being 8½ per cent. The increase of unemployment resulting from reductions of business activity varying from 40 to 75 per cent. of normal has affected labour unfavourably. Wage reductions running as high as 20 to 25 per cent. have accompanied the shrinkage of demand, and there has been falling off in the export trade. Banking power has been well maintained, normal credit accommodation has been extended to legitimate business, and the reserve ratio has grown stronger.—*Reuter's* (New York).

An Electrically-Driven Merchant Vessel.—The *Eclipse*, the first electrically-driven general cargo merchant vessel in the United States, was placed in service in October. It is a vessel of 11,868 deadweight tons, is 440 ft. long, and has a beam of 56 ft. The propulsion machinery consists of a marine turbine-generator set and a three-phase induction motor, which drives the single propeller shaft at a speed of 100 R.P.M. There are also two steam engine-driven, 125-volt, D.C. exciters, and control equipment for manœuvring the ship. The turbine is of the horizontal Curtis type, operating normally at 3,000 R.P.M., and was developed especially for marine purposes. The governing system is so arranged that the turbine is controlled by a variable-speed hydraulic governor at speeds from 20 to 110 per cent. of normal. The three-phase, 2,300-volt generator is especially designed for marine service. An induction motor rated at 3,000 H.P., and running at a normal speed of 100 R.P.M., which gives a total reduction from turbine speed of 30 to 1, is used to drive the propeller shaft. Ventilation is provided by a separate motor-driven blower. A water-cooled resister and a control panel make up the control equipment..—*Electrical Review* (Chicago).

BRAZIL: SOUTH AMERICA'S MOST POPULOUS MARKET.

Brazil emerged from the war in a strong position, and it is probable that the development of her enormous natural resources will be one of the chief characteristics of the coming years. Such is the pronouncement of H.M. Commercial Secretary at Rio de Janeiro in his report on the general economic and financial conditions of Brazil (Cmd. 840. Price 6d.).

It is true that since his words were written some amount of commercial depression has been caused by speculation, and a fall in the price of the products on which the prosperity of the country is based. But no doubt exists that the general economic condition of Brazil has improved fundamentally as a result of the war, that it is thoroughly sound, and that when the temporary depression has passed, Brazil will again offer a fruitful field for British enterprise, particularly in the direction of engineering.

The excess of Brazil's exports over imports during three recent years was as follows:—

1917 ...	£18,500,000
1918 ...	£8,350,000
1919 ...	£51,900,000

The weight of exports during this period varied, however, but little.

The figures of Brazil's foreign trade during the last six years show the inevitable changes brought about by the war with regard to Brazil's suppliers and buyers.* The following table expresses these changes in percentages:—

Percentage of Brazilian exports purchased by:—

	1913. Per cent.	1917. Per cent.	1919. Per cent.
United Kingdom	15	13	7 (estimated)
Germany	14	—	—
United States	32.5	48.5	42
France	10	13	22
Europe	58	38	48

Percentage of imports into Brazil supplied by:—

	1913. Per cent.	1917. Per cent.	1919. Per cent.
United Kingdom	24.5	19	15 (estimated)
Germany	17	.1	.06
United States	15.5	46	50
France	10	4	3.5
Europe	72	33	25

United States. These statistics of Brazil's foreign trade show how enormous has been the development of American trade owing to the conditions produced by the war. The advantages which the special position of the United States in the great European struggle produced for her generally in the world's trade have been patent in Brazil. She not only took Germany's place as an exporter to Brazil, but also was able to supply many goods which Brazil formerly purchased from Allied countries, especially from the United Kingdom. American traders would be the first to admit that the exporters in the United States did not understand this market at first. Their inexperience in market conditions led to misunderstandings on the part of the Brazilian importer. But the Americans have applied themselves diligently to this market. They have sent down hosts of commercial travellers, and they have learnt much, and of the trade which they inevitably gained much will be permanent.

Competition to be faced. The National City Bank of New York has opened branches in Rio de Janeiro and Sao Paulo, as well as elsewhere in Brazil. Other banks have also opened, which have met with difficulties, some in the matter of dealing with Brazilian exchange, and the older banks have had little or nothing to fear from them in this respect, but they have certainly grasped the importance of the purely commercial side of banking in the country, and in this respect seem inclined to imitate the policy of German banks. At the present moment American export trade to the country (as to others) is suffering from the high exchange rate of the dollar. But apart from this, it appears certain that British trade can, if the will exist, soon resume its normal leading position in the import trade of Brazil.

The Japanese are devoting a good deal of attention to Brazil as a market for their goods, but it seems doubtful if Japanese trade will be at all permanent with Brazil.

British goods have always enjoyed such a splendid and well-deserved reputation in Brazil that they may almost be said to have sold themselves. But the specious advantages of cheapness and long credits offered by our German competitors had begun, at the outbreak of the war, to create a position for our own trade that might eventually have become serious. There are many cases where the Brazilian importer, who would have preferred to purchase a British article which he recognised as far superior and worth more money, was obliged to buy from Germany on account of the immediate advantages which he could obtain by so doing.

The Germans interested themselves, too, in every phase of national industrial expansion. They thus found themselves allied with the powerful industrialist class.

The market is no longer the easy market it used to be. Competition is increasing daily. The Germans started it, and it looks as if the Americans would carry it on. There never was a time when so much care and real hard work were necessary. But the possibilities are enormous, and the establishment of more British firms in the country would enable Great Britain to get her due share not only of import trade, but of handling the increasingly varied export of Brazilian products. The internal development of Brazil daily presents some interesting features and prospects, and it is only by having sufficient people on the spot, acquainted with local conditions, that Great Britain can participate profitably in such development.

Stocks of Goods. It is high time that British manufacturers should convince themselves of the imperative necessity of having stocks of machinery on the spot. In the past they appear to have refused almost entirely to admit this point of view.

The average customer in Brazil will always buy on the spot, even if the machinery offered is not exactly what he requires, in preference to waiting for some months until his order can be executed.

It is therefore essential that standard types of machinery should be stocked. British houses have lost not inconsiderable business in the past through not having had goods in stock. Gas engines, for instance, are stocked by local Swiss houses for account of the Swiss manufacturers.

These remarks apply to cities like Rio de Janeiro and Sao Paulo, and it can therefore be imagined that they apply even more to such towns as Curityba, Porto Alegre, &c., where the farmers go into the towns at fixed intervals, and want to be able to buy at once such stocks of machinery, agricultural implements, &c., as they require, very often in exchange for their produce.

German stocks of electrical and agricultural machinery in the country enabled them to do a big business for a very long time after the outbreak of war, in spite of the fact that they received no direct supplies from Germany.

The articles which Brazil imports from the United Kingdom cover a very wide range. The importance of the British merchant and commission houses in Brazil in creating and developing that trade has been considerable, and although there seems to be a certain current of feeling which perhaps is not shared by manufacturers at home, that direct trade can and should be done without the aid of commission houses, it seems, nevertheless, that British trade with the country cannot be adequately dealt with and increased except with established firms on the spot. On the other hand, there is undoubtedly plenty of room for new British firms in Brazil, especially firms with technical men on their staff, *i.e.*, engineers and chemists. To supply the evident need for technical men should undoubtedly be the concern of the manufacturer, while the local agent or firm should supply the indispensable local knowledge.

Methods of Trading. More frequent visits to Brazil should be paid by the heads of firms having dealings with the country. Conditions are changing rapidly. Conversely, frequent visits home should be made by those in charge of British interests in Brazil. Greater encouragement should be given to younger men to devote themselves to the interests of the firms who employ them. A great outcry was raised some time back that new American firms were taking young Britons—and very often such as held responsible positions—from British firms. There was nothing so strange about this. The Americans were prepared to pay better salaries, and offered brighter prospects. It is perhaps just as well to take this opportunity of insisting on the need for good catalogues, printed if possible in Portuguese, while heads of firms should offer every inducement to their employés to learn the language of the country really well.

The British enjoy a far higher commercial reputation than any other foreign people in the country, far higher in fact than many British subjects here realise; and if use could be made of this well-deserved reputation, by adapting sound commercial traditions to the rapidly developing commercial needs and progress of the country, by "speeding up" and by making use of modern methods of advertising, &c., British trade to Brazil will soon occupy the first place which it enjoyed for so many years.

The Brazilian commercial delegates who visited the United Kingdom urged that British banks should, if possible, relax some of their traditional rigidity in Brazil. The scope for purely commercial banking (as done by the Germans) is believed to be increasing daily, and this new aspect will have to be seriously considered.

* It should be noted that Brazil's export trade to the United States consists almost exclusively of coffee and rubber, to which was added during the war, manganese.

Mineral Resources.

For coal Brazil depends almost entirely on what she imports, and the normal annual importation is nearly 2,000,000 tons. Coal exists in the southern States, especially Rio Grande do Sul, but has never been commercially exploited to any extent.

Iron ore is found abundantly, and with a high percentage of hematite. Various projects are on foot for the development of deposits, and there is every prospect of this becoming one of the most important industries in the country. The iron ore deposits in Minas Geraes alone are said to contain more than 3,000,000,000 tons of mineral, the percentage of metal being estimated to average 50 per cent.

Large quantities of manganese were exported during the war, and the value of 500,000 tons exported in 1917, most of which went to the U.S.A., was just double that exported in 1916. The idea of creating foundries in the country, instead of exporting manganese and iron ore, has taken hold of many leaders of opinion in Brazil. The principal difficulty is, of course, the fact that coal is not found in any quantity near the deposits of ore, nor are the supply and quantity yet assured. The use of coke is suggested, while the advocates of the views mentioned above also maintain that electric smelting is not only possible, but entirely practicable in Brazil. It is admitted that an enormous capital outlay would be essential to such a project in a country of such vast distances as Brazil, but it is suggested that the subsequent possibilities are so vast that the problem deserves the most serious consideration. The Government appointed two Brazilian engineers to investigate the question of the extraction of iron ore and coal, and the Mineralogical Department of the Ministry of Agriculture is also studying the question of hydraulic power for electrical furnaces.

Much attention has been directed recently to the commercial possibilities of petroleum deposits in Brazil—(the States of Bahia, Pernambuco, and specially Alagoas). A great future is claimed for such deposits, and numerous investigations are being made. It is claimed that Brazilian petroleum is purely of animal derivation and contains, therefore, more calories and a much less quantity of sulphur. The petroleum "area" has been estimated at 200,000 kilometres, and the deposits are said to be all close to the sea coast.

THE HEATING OF BURIED CABLES.

DISCUSSION AT LEEDS.

THE first meeting of the 1920-21 session of the NORTH-MIDLAND CENTRE of the I.E.E. was held at Leeds on December 14th, when the British Electrical and Allied Industries Research Association's report on the above subject, which was abstracted in our issues of December 24th and 31st, was enthusiastically received and discussed. Mr. C. J. Jewell, of Wakefield, chairman of the Centre, presided, and there was a good attendance of members.

Mr. E. B. WEDMORE, who represented the B.E.A.I.R.A., presented the report, and in a few words outlined the history of the research of the Association. The present report was an intermediate one, he said, and they had a mass of details much of which was of very great interest in itself, but which might be at present a little difficult to apply. They had not reached the stage where the tables could be put into shape for ready application to particular cases.

Mr. S. W. MELSOM summarised the work, the details of which were given in the report. The thermal resistivity of some cables was 1,200 in the units given in the report, others would be as low as 460, the difference between those two values varying by something like 20 or 30 per cent. the actual carrying capacity of the cable. That was a new path which they came upon and which they had stepped aside to follow for a long way. Then the air in a duct, so far as could be seen at present, was inert even when the cable was worn and they had the ends of the duct open. He hoped they would hear something about that matter, because he believed a lot of people thought that the heat did actually go through a cable duct if the ends were left open. The problem thus divided itself, first into a question of cables, and then that of the medium in which it was laid. As a result of the comparison between cables simply laid along the floor of a room in air, which was somewhat similar to the conditions when they had a cable cleated along the wall that was touching one of the sides as a conducting medium, they were able to get a certain factor which they had given as the ratio of the currents required to raise the core of a cable to a given temperature when it was laid in the air and when laid in the ground under various conditions used for laying cables solid in bitumen. The factor ranged from 1.22 to 1.23; for armoured cable direct in ground from 1.21 to 1.22, and for a cable pulled into a duct from 0.95 to 0.98. Thus there was a difference in the current-carrying capacity of a cable laid in the duct as compared with one direct in the ground, or solid in bitumen, of something like 25 per cent. From these factors they drew curves in order to compare their values with other people's values. In figs. 3, 4, and 5 they had drawn their results as compared with the German values. In fig. 3 there was a real difference between curves B and A, which was the German value reduced to the same temperature of the same size of cable and values obtained in curve B; the same thing showed, though not to quite so large an extent, in curves 4 and 5. Regarding the thermal resistivity of the ground, figures which were not included in the report were for bone dry soil, 340; for one containing 5 per cent. of moisture, 180; 10 per cent. of moisture, 120; 15 per cent. of moisture, 90. Thus the difference between 5 and 15 per cent. moisture was comparatively small; they might say that so long as they had something like 10 per cent. moisture in their soil all soils were practically alike. The thermal resistivity was governed almost entirely, as far as they could see at present, by the amount of moisture present. Generally the lowest figure obtained was 8 per cent. of moisture in the soil. What they would regard as a dry soil had something like 7 or 8 per cent. of moisture. The highest figures were obtained by Mr. Fawssett in Newcastle, where they had something like 20 per cent. of moisture in the ground. Fig. 6 gave the actual temperature of the ground at a depth of 2 ft. taken over a period of four years; for each year the highest points and the lowest points were really very near together, and the maximum temperature obtained, probably during August, was 18 deg. C. Dr. Marchant's thick lined curve on the same figure was slightly lower on the peaks, and was not irregular because he took mean values.

Mr. E. FAWSSETT thought credit should be given to the North-East Coast companies for their public spirit in financing his part of the research. The percentage curves at the top of fig. 7 showed enormous divergence in their general characteristics. Those on or above the thick average lines he thought represented the probable true effect as nearly as he could get it from the determination of the conditions at present known. He thought that the great difference in those characteristics was due to some small change in the relative moisture contents. It was conceivable that after heavy rainfall the moisture from 1 to 4 ft. would vary; actually it did not vary very seriously. Analyses had been made of the extra contents of the soil at certain intervals, but 2 or 3 per cent. would have a big effect when they were looking for small figures. It might be of interest to combine the effects of varying cable depths with the seasonal temperature changes in the soil. The latter changed over twice a year; for instance, in February the soil temperature at 1 ft., taking an average of certain years in Liverpool, was, say, 3 deg. C. At 2 ft. it was 5 or 4.6 deg., that was to say, it got warmer continuously as the depth increased, whereas in August it was the reverse, 17 deg. C. at 1 ft., and 15 deg. C. at 4 ft. Those two conditions of different depths might occur in an average run of cable between one and 4 ft., and taking one particular cable laid direct in the ground they might get 293 A at 1 ft., and a minimum in August at 4 ft. of 215 A, *i.e.*, a difference of 15 per cent. in current-carrying capacity in those two little conditions alone. On the top of that they had to consider the large effect of varying moisture contents, and also the class of soil. That was an illustration of the complexity of the problem of issuing tables for current-carrying capacity without a generous factor of safety. In summer conditions the top layer of earth over a cable was the hottest. What happened to the heat of the cable which could not come up to the top? Those of them with mining experience knew that below a certain layer it became hotter. There was a minimum temperature somewhere in summer which was probably at a point not more than 10 ft. deep. The cable might be laid somewhere in the minimum layer. What happened to the heat that was thrown off in that minimum temperature? As far as he could say, it went sideways. The problem considered from a mathematical point of view was quite other than where the heat came straight up to the surface. They got a condition which would never reach finality of temperature.

Mr. GILLING (Bradford) observed that before any practical results could be shown the physical and economical characteristics of cables in use for long periods of time and under working conditions must be known, and should, therefore, be the first problem to be solved. That work appeared to have been left to the last. The suggestion that the effect on the cable of the nature of the ground should be recognised when laying the cable was very valuable, as it was now evident that in heavily-loaded cables the weakest point was that which they had been accustomed to regard as probably the strongest. The difference in carrying capacity of cables in a duct and underground was also definitely shown. Another item of great interest was the fact that a cable laid 4 ft. deep must be rated lower than if laid 1 ft. deep.

Mr. COOPER thought that the jointing of a long length of cable became rather important as well as the current-carrying factor, and that high pressures would cause a greater rise of temperature than the low ones, not just because of the dielectric, but owing to the pressures. In the tests none of the figures had been taken with the working pressure.

Mr. W. M. SELVEY explained that the particular feature of a control experiment was one in which one could choose one's condition, and it must be of such a nature that one could repeat it indefinitely and get reasonably the same result. Mr. Melsom had adopted a control experiment to start with, namely, to lay a cable on the floor, and he controlled some of his variants but not others, such as colour condition of surface. He also omitted any reference, which was of considerable importance, to the temperature of the envelope and

the space which considerably affected the radiation. Every question of low temperature was one of radiation and exchange between the envelope and the container. Mr. Melsom did not define in what way this cable rested on the floor or how close it was to others, although he (Mr. Selvey) gathered that he could not use the lead sheaths because the cables were in contact. They could have used a thin sheet of mica which would have kept the cables electrically distinct without interfering with the heat problem. Further, Mr. Melsom did not indicate the kind of floor used, so he, the speaker, suggested that his control experiment was not really an efficient one to start with. The control experiment must be beyond doubt; the only satisfactory control experiment was to suspend cables in air by thin threads which were non-conductors. The final report must be edited by one man; for instance, Mr. Melsom had too many variants. Mr. Fawssett had got the genuine goods, but instead of taking as a basis Mr. Melsom's 2-ft. cable, he took a 1-ft. cable. An enormous amount of work had been done by agricultural experts on the capacity for the absorption of air by soils of different composition; they had much data on that question. What they wanted to investigate was really the condition of a soil which refused to part with more than a certain percentage of its moisture at a certain temperature. Obviously if they laid their cable in perfectly dry sand, which might be a control experiment of the maximum limit of heating, the capacity of the cable would be practically nothing. It was possible to select what they chose to immediately surround their cable with. They could to some extent select as well as treat the soil in such a way as to do two things, first, to minimise the amount of moisture that could be driven off by a certain temperature, and, secondly, to increase the envelope of the cable, to increase the periphery, and thereby diminish the temperature which came into contact with the soil.

Mr. FRENCH pointed out that there seemed to be a discrepancy as far as he could read the tables or the curves between the figures of the N.P.L. and those given by Prof. Marchant; in one case they had a fall, and in the other a rise of temperature. He agreed with Mr. Selvey that it would be beneficial if one man edited the report; at present the reading of the report was extremely difficult. He missed any definite practical statement of what could be expected from a cable under certain conditions of loading per unit surface radiation; the tests, so far as he could see, gave no conclusion whatsoever as regarded the thermal time constant of a cable. He would have thought that it would have been a very simple matter to do so.

In replying to the discussion, Mr. S. W. MELSOM agreed fully with Mr. Gilling and other speakers on the question of deterioration. With regard to the question of adjacent cables, they would very shortly be in a position to give further information. It would never be possible to give a certain figure for the current to which a cable should be loaded. The man who had to consider the figure which he would use had to remember that there would be certain factors which could not be defined in two or three figures, but the figures would have to be given for a condition with a statement of what variable factors would affect them. The cable engineer would have to use his own brains and see how far those conditions were affecting his own practice. Other countries had issued a load curve for cables; those curves were wrong, because sufficient attention had not been given to the variable factors. Dealing with Mr. Selvey's remarks, he pointed out that the floor on which the cables were laid was a wooden floor, and in general they were laid as they would be laid on the ground. The heating from the adjacent cables did not affect the result. The best measure of the suitability of a particular experiment as a control experiment was whether it could be reproduced. On those cables they were able to reproduce the results when laid along the floor with a remarkable degree of accuracy. The experiments required a high degree of skill; with the best will in the world, but without the proper laboratory craft, no one would be able to reproduce them. Mr. Selvey had questioned the validity of the fair statement of Russell's formula for calculating the thermal resistivity of multi-core cables. Russell's formula was based largely on a formula evolved by a German named Moewe; they had had that formula examined by an eminent mathematician, and he pronounced it to be valid. They had made arrangements to check it experimentally.

ELECTRICITY DISTRICT SCHEMES.

By HENRY M. SAYERS, M.I.E.E.

SCHEMES for the improvement of the existing organisations for the supply of electricity in some of the districts provisionally determined by the Electricity Commissioners have been prepared.* The ELECTRICAL REVIEW has published an abstract of that for the Lower Severn District, which has been prepared by a committee representative of the municipal authorities in the district, and in this issue appears an abstract of a scheme for the North Wales and Chester Electricity District prepared by the Corporation of Chester. This had not, at the date upon which it had to be submitted to the Commissioners been considered by the other local authorities and undertakers concerned. The Lower Severn scheme, which one may fairly call the Bristol scheme, has, however, been discussed at meetings and by correspondence between some of the parties, and is to that indefinite extent an agreed scheme. The Chester scheme is not a formally agreed one, though it shows signs of consultation with other bodies in the course of preparation.

It may be noticed that other schemes than those published may have been prepared and submitted to the Commissioners, since it is open to quite a large variety of associations and bodies within the districts to prepare and submit a scheme. The words of the 1919 Act (Section 5 (2)) are so elastic that it is difficult to say that anyone is specifically excluded from the privilege, and until the opening of the inquiry in each case, when presumably an announcement will be made, only the Commissioners can know with certainty what schemes have been submitted, and who is responsible for each. Hence it must not be assumed that no other schemes will be put forward for inquiry than those published; or that the Commissioners will approve of either of these. The Commissioners are at liberty to disapprove of any scheme or schemes, and may (but not must) themselves formulate such a scheme. Hence the two schemes herein considered cannot be taken as examples of the schemes likely to be approved; they may be or may not be, that remains to be seen. At present they are examples of what the bodies which have prepared them consider desirable, and consistent with the very wide provisions of the Electricity (Supply) Act, 1919. Only after one or two of the earlier inquiries have been held and approved schemes promulgated will it be possible to judge what kind of organisation will be favoured by the Commissioners, who may not improbably use their discretion with more regard to the conditions in each district than rigid adherence to a particular model scheme. This latitude is a good point in the Act.

The Commissioners issued a memorandum setting out that schemes submitted should contain proposals for the technical, administrative, and financial organisation to be adopted, and with regard to the technical scheme some estimate should be made of the future demands for electrical energy which the scheme will have to meet. Seeing that the primary object of any scheme is to provide "a cheap and abundant supply of electricity" throughout the district, which shall be an improvement on the existing supply, it appears that the technical features of the scheme must be the core and substance of the whole thing. The administrative and financial organisations can only be judged of by their apparent capacity and suitability for the execution of the technical scheme. To design an administration with certain financial powers without giving an outline of the work it is to accomplish seems rather lacking in meaning. It is difficult to imagine that the Commissioners will make orders giving effect to such incomplete schemes. They will, one supposes, even if they find it proper to adopt the other parts, lock on to them a technical scheme, that is, they will not set up a machine without saying what work it has to do, and seeing that it is reasonably fit to do it.

It is, therefore, surprising to find that the Lower Severn scheme (called "Bristol" for short hereafter) has no technical side at all. Whether any work has been done on that side, statements and estimates prepared of the present condition of electrical supply, of future requirements (and the means of meeting them), plans for extension and cheapening of supply, does not appear from the documents published. From what has transpired of the discussions between the bodies interested it seems that those who prepared the scheme consider it premature to go into these questions. Unless they are seriously misrepresented, they think that the machine should be set up first, and that after that has been accomplished it may be decided what it shall set itself to do. This seems to be a somewhat topsy-turvy way of going to work.

The Chester scheme is based on what seems to be the right principle. It includes statistics of the existing supply undertakings, their plant capacities, maximum loads, and annual sales, a statement of the potentialities of the district, with a list of the principal industrial centres, and estimates of the demands at three future periods of development in each area, which forecast triples the present demand and consumption of electrical energy; and proposals for the erection and equipment of three large generating stations, two

* Dec. 24th, p. 224 and Jan. 7th, p. 11.

of which will utilise proved water powers. The main transmission lines and the location of sub-stations are listed, and estimates of capital expenditure, income, and working expenditure, set out for the three future periods of development. The costs of the existing stations are tabulated, and suggestions made about which of these should be developed, and which should be disused as the bulk supply system becomes available. This is surely the way the work should be done. Although the scheme is that of the Chester Corporation, it is clear that in the preparation of the technical part there has been hearty co-operation of the other undertakers and local authorities, and every consideration given to the requirements and interests of all parts of the district. The work to be done by the Joint Electricity Authority is set out. The constitution and financial powers of that authority can, therefore, be judged with reference to the programme proposed.

To criticise this programme usefully would require about as much time and knowledge of the local conditions as has gone to the making of it. No doubt those interested will have something to say at the inquiry, but they will go to the inquiry with previous knowledge of what has to be discussed and, therefore, prepared to amend it if it seems faulty. The estimates of cost per unit sold, it is interesting to notice, show a very material saving on the present costs from the existing stations. This is a very satisfactory feature, showing that in the opinion of those who prepared the scheme, the objects of the 1919 Act can be realised.

As the Bristol scheme contains no technical section, no comparison of the two is possible. This is to be regretted, because the Lower Severn District, from its diversity of industrial and social conditions, is one for which a reasoned forecast of electrical development should be particularly interesting, all the more so because it includes the Hereford area of supply, in which so much has been done to encourage agricultural and rural demands.

As regards the constitution of the Joint Authority both the Bristol and the Chester schemes follow the wording of Section 6 of the Act in general concerning the interests to be represented, but they both overlook a point in that wording which is of importance. The Act says that a scheme may provide for the establishment "of a Joint Electricity Authority representative of authorised undertakers within the electricity district, *either with or without* the addition of representatives of the Council of any county situate wholly or partly within the electricity district, local authorities, large consumers of electricity, and other interests within the electricity district." The essential element to be represented is the authorised undertakers. A Joint Authority may be set up either with or without representatives of other interests. It is arguable, therefore, that all the authorised undertakers are entitled to representation, to the extent at least of having voting power in the election of members of the authority. The Bristol scheme proposes that the authority shall consist of representatives of "any or all" of the authorised undertakers, which clearly admits of some undertakers having no representation. The Chester scheme defines authorised undertakers in such a way as to exclude any undertakers who have not at the time of the scheme coming into operation expended at least £30,000 on their undertaking. It may be expected that the Commissioners will read the Act as obliging them to give every authorised undertaker some representation on the authority, though not necessarily a representative.

The Chester scheme sets out a very elaborate "constitution" for the Joint Authority. The members are to be elected by classes of constituent authorities, each of which constituents may vote only for representatives for its own class. The voting power is defined in "units," of £1,000 rateable value, £1,000 capital expenditure, and the consumption of 25,000 electrical units per annum, for the cases of local authorities, authorised undertakers, and large consumers respectively, but any constituent authority having a rateable value of £200,000, any authorised undertaker having a capital expenditure of £200,000, and any large consumer with a consumption of five million units will be entitled to appoint one representative on the authority for each such block of rateable value, capital expended, or consumption.

There is an optional element, or rather a double option in this constitution which, if approved, will give the scheme a voluntary character. In the first place, any body qualified for representation may become a constituent member of the Joint Authority by giving four weeks' notice before the date of the first election. In the case of a local authority which is not an authorised undertaker this notice is to state that it accepts "financial responsibility" in proportion to its rateable value. In the second place, after the scheme is sanctioned each constituent authority is to enter into an agreement under seal with the Joint Authority binding itself to the provisions of the scheme.

It may be doubted whether these voluntary features will survive the scrutiny of the Commissioners; local authorities cannot at present bind themselves to "financial responsibility." The original 1919 Bill, and the two 1920 Bills, proposed to give them certain powers to lend money and give guarantees to Joint Authorities, but those provisions are not yet law, now did they sanction so general an assumption of responsibility. Under the Act a scheme has to be approved by the Commissioners, the Minister, and both Houses of Parliament, and when made effective by such triple approval, it will be law. It is unlikely that it will be permitted to any authorised undertaker or important local authority to remain outside, or to come within, the jurisdiction of the Joint Authority, of its own choice. It would be particularly awkward that any authorised undertakers should be within the area of the Joint Authority, and yet without its legal jurisdiction. Possibly some option may be given to the smaller local authorities, large consumers, and other interests, but it will probably take the form of a right to representation on the Joint Authority if they choose to fulfil certain conditions. But as regards authorised undertakers it seems in accordance with the objects of the Act to make the scheme compulsory, which implies the right to representation on the Joint Authority.

Perhaps these voluntary provisions in the Chester scheme are consequences of its preparation by one authority only, which did not like to suggest compulsion of its neighbours. The Bristol scheme also contains provisions for allocating voting power in proportion to units sold in the area of each constituent, whether authorised undertaker or local authority (so that it seems that in the case of a company, both the company and the local authority of the area will get voting power from the same "units sold"), excepting that the County Councils jointly will have a right to appoint three members, these County Council members will have no voting power unless and until the Council or Councils appointing them assume "commensurate financial responsibility." The Bristol scheme does not propose to confer voting power on local authorities on a rateable value basis, in which point it seems more logical than the Chester scheme. The unit voting power is to be 50,000 units sold; this holds up to 500,000 units, which gives ten votes, and, thereafter, there is a sliding scale terminating with one vote per 100,000 units for sales above 2,500,000 units annually. Constituents of the same class may pool their votes, and no single body or pool may be entitled to exercise voting power in excess of 45 per cent. of the votes held by all other bodies. Quite a nice examination question in simple equations to say what maximum percentage of the whole voting power may be exercised by one body. Curiously, the Chester scheme also uses the figure of 45 per cent. as the limit of the proportion of the total number of representatives on the Joint Authority which may be appointed by one constituent. But the result is quite different in the two cases. The Bristol scheme proposes to limit the membership of the Joint Authority to 30. The Chester scheme mentions no number. This will certainly have to be inserted in any approved scheme. The Bristol scheme does not define how "large consumers'" representation is to be allotted, an omission which will require to be made good.

Turning to the duties of the authority, both schemes agree in adopting generally the wording of the 1919 Act, in which they can hardly be criticised, since Parliament has settled them. The Bristol scheme, containing no technical programme, quite consistently embodies no special powers for carrying out such work, the Chester scheme with equal logic embodies powers to construct generating stations, transmission lines, and distributing systems. But it may be said that as the statutory duties of Joint Authorities imply the possession and exercise of these powers, the Commissioners will doubtless see that approved schemes impose the duties and confer the necessary powers. The duties of bulk supply to authorised undertakers and others and the powers of control over authorised undertakers in respect of generation will need to be set out in more detail, so that every authorised undertaker and the Joint Authority will be made aware of their respective rights and duties. However, the Act gives the Commissioners powers, not only in making the scheme orders, but afterwards to supervise the proceedings of the bodies concerned, and will no doubt insert sufficiently definite clauses in approved schemes.

As regards prices for bulk supply, the Chester scheme proposes that the Joint Authority may charge higher rates in districts where the undertaker or the local authority did not become a constituent authority, a curious kind of moral suasion. But it may be doubted whether such holding back will be permitted as above stated.

With respect to financial powers, both schemes propose that the Joint Authority may have power to raise money by the issue of stock, bills, bonds, or temporary loans, in language familiar in local authority Acts. It may be noted that the 1919 Act does not specifically say that Joint Authorities may be endowed with such financial powers. They may be held to be included in the very wide terms "and the scheme may contain any consequential, incidental, and supplemental provisions which appear to be expedient or proper for the purpose of the scheme," but it is not usual for financial powers to be granted to a statutory corporation in such terms, and it is a question whether the Commissioners will be advised that such powers can be given under the 1919 Act. In this connection it is significant that both the amending Bills introduced (and withdrawn) during the session of 1920 contained clauses permitting the Commissioners to confer specific borrowing and consequential powers on Joint Authorities; and it is anticipated that the Government will endeavour to pass the No. 2 Bill of 1920 at an early period of next session.

Whilst this question of financial powers is in a doubtful phase, it is perhaps futile to comment on the two schemes under discussion. They will, in any approved form necessarily conform to whatever statutory provisions may be in force.

Both schemes propose to empower the Joint Authority to

levy a deficiency rate upon the constituent authorities, which may be met—in the case of local authorities—out of rate provided funds. It is perhaps hardly necessary to say that to carry out this proposal the local authorities will require statutory authority, and that legislation to this end will not be popular. The Commissioners cannot impose this obligation on local authorities as the law stands at present. But as a condition in any agreement or contract for bulk supply it seems permissible to include liability to a contribution to make up a deficiency in the revenue accounts of the Joint Authority, based on the proportion of the whole supply taken by each consumer. This would not come directly from the rates, in the case of a local authority undertaker, though it might eventually be borne by them. Under present conditions it may be surmised that any direct or indirect call upon the rates by Joint Electricity Authorities will be given, if at all, with great reluctance, and under severe limitations and regulations.

This criticism of the two schemes is necessarily incomplete. The task of drafting the pioneer schemes, with the very scanty detail afforded by the 1919 Act, and the memorandum of the Commissioners which leaves a great deal of freedom to the draftsman is a somewhat delicate one. It is a duty imposed upon no one in particular, so that considerable credit is due to those who took up the task. They have at least given some assistance to the Commissioners by showing what some of the interested parties consider schemes should cover. It would have been better if schemes had been prepared with the general agreement of all the authorised undertakers in a district, but this is a good deal to expect.

Of the two schemes considered, one inclines to think that of Chester the better. It embodies a practical programme, it offers to authorised undertakers and consumers definite benefits and inducements to support it. The Bristol scheme is unfortunate in the omission of such features. No one can read it through and say that it promises any assistance to any class. No doubt those who prepared it thought it better to leave future plans to the deliberations of the authority after it has been set up. It is doubtful whether the Commissioners will agree, or will think that the Lower Severn Scheme gives them all the assistance they had a right to expect.

But seeing that the whole work, in all cases, has been voluntary, and of considerable magnitude, the Commissioners and the supply industry generally will recognise their obligations to those who have blazed the trail. No doubt in a few months there will be a set of standardised clauses which will become common form. Then the essential technical programme which must vary with every district, will get its due attention as the important feature of any scheme

A JOINT ELECTRICITY AUTHORITY.

THE CHESTER AND NORTH WALES SCHEME.

WE abstract below the scheme which has been submitted by the Chester Corporation for the formation of a Joint Electricity Authority for the provisionally delimited North Wales and Chester Electricity District.* A criticism of the scheme appears above, and following our usual practice we only deal hereunder with those points whereon the scheme differs from those of which outlines have already been published.† We shall, therefore, confine our remarks to the technical portions of the scheme, in which it is pointed out that the district embraces an area made up of extreme geographical conditions, parts of which are comparatively densely populated, and parts sparsely inhabited. There are large tracts of rich agricultural land, considerable undeveloped minerals, extensive coalfields and other natural materials required for daily use and a large expanse of mountainous country with a considerable amount of water power; in fact, the district contains the natural resources and facilities for the development of valuable industries of great national importance and value.

The system of supply proposed will be of 3 phase, 50 periods, 66,000 V, and 33,000 V by main overhead transmission lines of 0.1 sq. in. and 0.2 sq. in. section, and local secondary transmission at 3 phase, 50 periods, 6,600 V. It is proposed that a steam generating station shall be erected on the estuary of the river Dee, where there are facilities for a station capable of developing 150,000 kWh, and that the water power resources in the district, estimated as capable of providing 200,000,000 units per annum, shall be utilised as required.

At present there are in operation in the district, giving a public supply, 20 generating stations, of which it is suggested to discard, when a bulk supply is available on satisfactory terms, 18 stations, including the existing steam station at Chester, nine of which are owned by local authorities and nine by companies. The following hydro-electric stations will be retained, of which those having suitable facilities for extension will be enlarged when the demand for electricity makes such a course necessary: North Wales Power Co.'s Cwm Dyli and Dolgarrog, Yale, and Chester stations.

As the demand for electricity arises new hydro-electric stations can be constructed at Dolgarrog, Maen-twrog, on the river Dee, between Llangollen and Erbistock, various small hydro-electric stations for isolated areas, and a steam station on the estuary of the Dee. It is not proposed to ask the Ministry of Transport to construct any of the foregoing works.

Having regard to the exceptional circumstances existing in this district for the generation of cheap electrical energy, it is suggested that the Ministry of Transport's attention should be especially drawn to the particular advantage in this district regarding main line electrification of railways.

Although it is stated that the estuary of the Dee offers facilities for a steam generating station of a capacity of 150,000 kW, and for hydro-electric installations to give 200,000,000 units per annum, it is not intended to convey that these developments would exhaust the resources of the district for the generation of electricity by natural sources of power; the instances referred to merely embrace propositions which have been carefully investigated. There is little doubt that there are other resources from which a considerable additional quantity of electricity could be economically produced. The southern part of the North Wales and Chester district will in all probability be electrically isolated for a considerable time from the northern and western parts, but as it contains many small water power resources there is every prospect on a detailed examination of the conditions of showing that practically all the townships in the southern section can be supplied from hydro-electric developments. The existing plant in the district had a total capacity in 1920 of 19,813 kW, the maximum demand being 13,425 kW and the output 42,227,713 units.

The area includes extensive coal mines, granite, limestone and slate quarries of importance, and the richest lead ore district in the country. At the present time several new industries are being set up, and had a supply of electrical energy been available, there is no doubt that extensive developments would now have been in hand. It is not anticipated that extensive electric traction will develop, other than the electrification of railways, but when electricity supply is available, electric power will rapidly supersede the oil and other engines now in use for agricultural purposes. Given a cheap and efficient system of supply great calls will be made for electricity for domestic purposes, especially in the seaside and other holiday resorts.

The demand for electricity for the foregoing requirements is estimated as follows:—Immediate requirements and first period of development, 36,900 kW demand and 76,250,000 units per annum; second period, 51,200 kW and 109,000,000 units; and third period, 64,300 kW and 135,650,000 units.

The steam station which it is proposed to erect on the estuary of the Dee will in the first instance contain the necessary apparatus for two 5,000-kW turbo generators, comprising water-tube boilers for a working pressure of 250 lb. per sq. in., mechanical stokers, steam superheaters capable of giving 150 deg. F. superheat, feed water economisers, steel chimneys and induced draught, overhead coal bunkers, coal and ash handling plant, surface condensing plant arranged to take water from the river Dee, and three-phase, 50-periods, 6,600-V alternators direct coupled to the turbines. A suitable switchboard to control the generators, and local secondary transmission for the supply of the district within eight miles radius of the generating station, and e.h.p. switch gear and transformers to step-up from 6,600 to 33,000 V, for the control of the main transmission lines. Each unit is to be self-contained, with its condensing plant, battery of boilers, &c. Such an installation operating at 35 per cent. load factor would produce 15,000,000 units per annum.

A complete report on the development of low-fall water power on the river Dee was prepared for the Board of Agriculture and Fisheries, and dated April 16th, 1919. [ELEC. REV., May 30th, 1919, p. 647.] For the purpose of this scheme it is proposed to utilise the section of the river Dee between Llangollen and Erbistock, where there are facilities for the erection of 12 low-fall water-power stations, and the formation of dams and waterways to produce heads of water varying from 9 to 37 ft. Each installation would consist of two water turbines coupled to two d.c. generators in series, the installations being arranged on the Thury system, and the electricity generated at the installations transmitted to a central converting station where it would be converted to a.c., 3 phase, 50 periods, 440 V, and by step-up transformers to 33,000 V for main transmission. The 12 stations would provide 50,052,000 units per annum.

A description of five other proposed hydro-electric installations will probably be submitted by the North Wales Power Co. In the Vale of Clwyd there are water power resources and in a single instance the erection of a dam 50 ft. high, and the use of plant capable of developing 1,000 kW would generate approximately 3,000,000 units per annum, which would be sufficient for the requirements of the valley from Denbigh to Rhyl for some time. The existing overhead main transmission lines owned by the North Wales Power Co. total 70 miles in length, but the immediate requirements of the first period of development are 230 miles of line; second period, 73 miles; and third period, 50 miles, with 18 sub-stations on the transmission lines.

In conclusion, financial statistics, together with figures of the fuel cost and consumption of the existing undertakings in the district, are set out. The draft scheme is signed by Mr. S. E. Britton, city electrical engineer, and the town clerk, Chester.

* ELEC. REV., July 23rd, 1920, p. 107.

† ELEC. REV., December 24th, 1920, p. 809, and January 7th, 1921, pp. 4 and 10.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Subter" Bell and Relay.

The Home Office requirements with regard to bells and bell circuits for use in mines are: (*a*) That the e.m.f. of the battery used in bare wire signalling must not exceed 25 volts; (*b*) That any bell or relay used for bare wire signalling must be capable of standing 25 volts without giving rise to a dangerous flash on the bare wires at the point of break; and (*c*) That even though the normal working pressure of the bell or relay may be low (say, 10 volts), it must still comply with condition (*b*). To fulfil these requirements MESSRS. STERLING TELEPHONE & ELECTRIC CO., LTD., Telephone House, 210-212, Tottenham Court Road, W. 1, have produced their "Subter" bell and relay (figs. 1 and 2). The bell is fitted with parallel-wound coils, in a gas- and water-tight case with a broad machined joint. All live parts are carefully insulated from the case, and the cover is fitted by means of key-headed screws, which cannot be entirely removed, and which can be sealed by a wire. The "Subter" relay has a case similar to that of the bell, and the screws may be sealed in the same manner. Three standardised resistances (20, 100, and 500 ohms) are supplied, but special winding is provided for large orders if necessary.

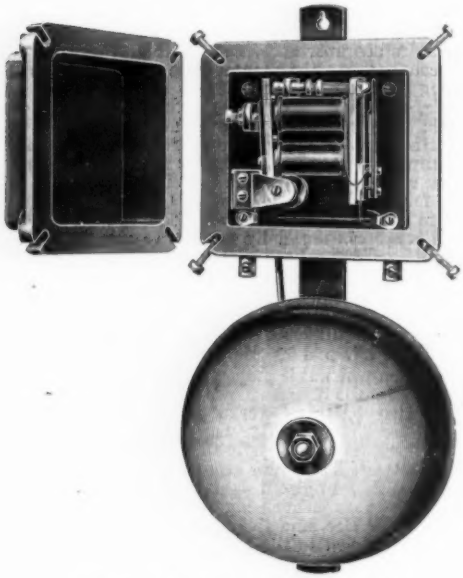
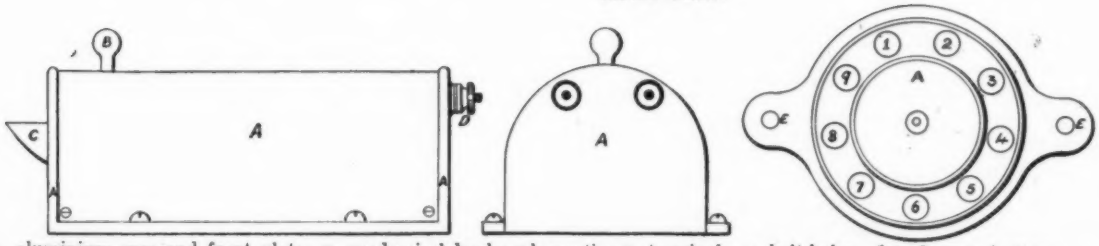


FIG. 1.—THE "SUBTER" SAFETY BELL.

FIGS. 3 AND 4—
A "HALF-WATT" SAFETY CAGE.

FIG. 2.—THE "SUBTER"
SAFETY RELAY.

FIG. 7.—THE "ELECTROLUX"
SUCTION CLEANER.



A, aluminium case and front plate; B, mechanical knob; C, brass tip; D, terminals; E, bolt holes. 1 to 9, press-buttons.

FIGS. 5 AND 6.—AN ELECTRICAL COMBINATION LATCH.

A "Half-watt" Safety Cage.

To meet the growing demand, which has sprung up since the introduction of the "half-watt" type of lamp, for a means of supporting the fittings and reflectors which have become a part of the methods of illumination by these lamps, Mr. W. BROADBENT, 11, Wellington Street, Moss Side, Manchester, has introduced a safety cage for attachment to existing ceiling roses. As will be seen from the illustrations (figs. 3 and 4), the device consists of a ceiling rose clamp, three chains, and a heat deflector fitting over the lamp-holder. In fixing, the screws of the ceiling rose are loosened and three lugs on the clamp are fitted between the wood block and base. The clamp is then closed and the ceiling rose screwed up. Fig. 3 shows the fitting applied to a lamp only, and fig. 4 illustrates the heat deflector reversed to fit a 2½-in. shade.

A Keyless Electro-mechanical Latch.

MESSRS. CHRISTIE & METCALFE, of 4, Verdun Terrace, Ballygomartin Road, Belfast, have devised an electro-mechanical latch and combination switch, which is illustrated in figs. 5 and 6. The latch is electrically operated by means of a specially designed combination switch, so that no keys are required. Connections, or combinations of connections, are made on the switch, and only those who know the "set," can operate the latch. Any desired combination can be "set" in a few seconds, and can be changed at pleasure without using the same set twice. A burglar alarm attachment can also be incorporated with this switch so that anyone who does not know the latch combination, on tampering with the switch, immediately gives the alarm. A series of these latches can be operated by one controlling or master switch, installed in any desired position. Both devices are neat in appearance, and have been thoroughly tested; they are made in various sizes, and to suit voltages from 100 to 500. For individual use, these appliances are suitable for hotels, private offices, strong rooms, store rooms, jewellery show cases, &c. Where a number of doors are required to be opened instantaneously, the latches are specially applicable. The inventors, from whom further particulars can be obtained, have applied for a patent.

The "Electrolux" Suction Cleaner.

A number of departures from the usual lines of electric vacuum cleaners are embodied in the "Electrolux" cleaner, sold by the "Z" ELECTRIC LAMP & SUPPLIES CO., LTD.,

73, Newman Street, W. 1. This is a very compact device, as will be seen from the illustration (fig. 7). The dust-bag is inside the casing—a very convenient arrangement, and the motor is fitted at the top. When being used for purposes other than floor or carpet cleaning the container and motor can be slung by means of a strap across the shoulder, giving great adaptability and ease of employment.

The ½-h.p. motor has a normal speed of 8,000 r.p.m., giving a working suction equivalent to 16 in. water gauge. The "Electrolux" is manufactured in Stockholm and the "Z" Co. hold the agency for the British Empire.

CORRECTION.—In our note on MESSRS. HENLEY'S distribution pillar, on p. 31 of our last issue, the example illustrated was inadvertently described as a "3-phase, 4-wire" type. This should have been "d.c., 3-wire."

REVIEWS.

Electric Switch and Controlling Gear. By C. C. GARRARD, Ph.D., M.I.E.E., A.Am.I.E.E. Second edition. Pp. 654 +xxii; 529 figs. London: Benn Brothers. Price 25s. net.

Dr. Garrard needs no introduction to our readers, since for many years he has been recognised as one of the leading authorities on all matters relating to the control of electricity, and the success which has attended his book on switchgear is testified to by the early appearance of a second edition of the work.

In the preface to the new edition the author states that, while the book has been revised and enlarged to a certain extent, no considerable alteration has been made. This statement, while quite correct, does not adequately convey to the reader the great pains which have been taken to keep the book thoroughly up-to-date. On comparing the first edition with the one at present under notice, we find that many entirely new diagrams have been introduced, and in other cases diagrams of certain types of apparatus have been replaced by diagrams of newer or more interesting patterns. Improvements of this nature are noticeable throughout the work, but more particularly in the section dealing with the prevention of dangerous conditions of current and in that dealing with the starting and control of motors.

Perhaps the most noteworthy of the new sections of the book is that dealing with contactor types of gear for use in controlling motors working on heavy service. This section includes an account of the contactor itself (in which types for use on direct, alternating and high-pressure circuits are described), together with information concerning the relays necessary to ensure that the contactors are operated in the correct sequence and with the correct time intervals. It is a section dealing with a subject of increasing importance, and will doubtless be added to in future editions.

Rules and regulations (so far as they concern switchgear) issued by various associations formed an important part of the first edition, and these have been brought up to date and increased in number, the most noteworthy addition being concerned with regulations regarding the equipment of ships; references are also given to such of the publications of the British Engineering Standards Association as relate to the subject matter of the book.

The number of appliances described in the book is indeed legion, and one must feel a deep sympathy with the engineer of a large system called upon to decide the best mode of protection of his plant against the many possible sources of disturbance which may arise. He must look forward to the day when more experience has been gained and matters have become more standardised.

The book should be looked upon as a standard work, and no engineer concerned with the design, manufacture, installation, or operation of electrical plant can afford to dispense with its aid. The printing and diagrams are excellent, and, considering the bulk of the volume, the price is most moderate.

Tramway Motorman's Handbook. By W. S. IBBETSON, B.Sc., A.M.I.E.E. Pp. 208; 47 figs. London: E. & F. N. Spon, Ltd. Price 6s. 6d. net.

The author has made a praiseworthy endeavour to put a mental stepladder into the grasp of men who, almost universally, are trained (and evidently regarded) as machines. The control gear of the modern tramway car, elaborate as it is, does its complicated work by the mere turning of a handle.

Most tramway managers, and the majority of motormen, quite lose sight of the many and far-reaching economies in the use of power, but more particularly in the tremendously reduced maintenance costs of overhead line, of track-work, and, above all, of car equipment, which might be attained by intelligent and discriminating operators of that simple handle. The title chosen hardly denotes the scope of this little work, as repair men, and, indeed, all classes of practical tramway workers are catered for.

The first chapter is introductory, and explains the every-day terms used in electrical work; Ohm's Law is given, and examples of its use are shown. Definitions of the simpler mechanical units are also included. There is no use made of mathematics.

Chapter II describes briefly the "Distribution of Power," mainly by the single trolley-wire system; Chapter III deals with "Rolling Stock and Car Equipment," and, bearing in mind the scope of the book, covers the subject well. In Chapter IV a brief description of a tramway motor, treating its component parts and their uses separately, is given. Shunt, compound, and series motors are compared, and the advantages of the latter type for traction work stated.

Chapter V handles "Brakes and their Operation." The hand, air, and magnetically-operated types are, in turn, considered. An explanation of "regenerative control," and a large number of useful "don'ts," and "what-to-dos" are also included in this instructive chapter.

"The Controller" claims Chapter VI. and vies with the previous subject in elaboration. This is as it should be. A motorman's chief concern is the operation of controller and brake. Two standard controllers, of well-known makes, are illustrated, and complete connection diagrams given. The diagram on page 150, being full page, is clear enough, but that on page 158 will not be traced through by many, being entirely too small.

Chapter VII is devoted to "Faults." The author cogitates on the proper boundaries of a motorman's sphere in the realms of "trouble shooting," and his opinion is that a properly trained man will locate and remedy minor faults, thus saving much time, whereas the untrained type, "rushing in where angels fear to tread," will make more trouble still. However, this chapter will doubtless find many readers (and beneficiaries), who are repair-men, and the carefully tabulated lists of faults, their effects, location, and remedies, on overhead equipment, and every species of apparatus on a car, will no doubt be found of use in many a depôt.

A seven-page, carefully prepared, index completes the book.

There are a number of errors—some typographical. Paragraph 7: Final equation should be:—

$V=12.5\times4$. Pressure = 50 volts.

Paragraph 22: The kilowatt-hour is described as "the energy transformed in a circuit. . . ." "Consumed" would be a more fitting word than "transformed."

Paragraphs 20 to 23 and 45: The author should make it perfectly clear that his formulæ and examples refer only to direct current work. Some of his readers *may* handle three-phase motors in repair shops.

Paragraph 33: The definition given of "torque," would describe better the "tractive effort of a car." Also torque expressed in "pound-feet," and the unit of work given as the "foot-pound" on the same page, are sure to lead to misconceptions. It should have been explained that torque is a twisting effort, and that a convenient unit is "a force of one pound-weight acting at right angles to a radius arm one foot in length."

Paragraph 126, page 74, third line: "Tapings" should evidently read "tappings."

There is a tendency throughout the book towards the use of loose phraseology. One example is the constant use of the word "auto," when "automatic switch" is spoken of. There is enough slovenliness in the use of technical terms without its being encouraged by writers, who are expected to know better, and who should remember that a great many of their readers will model their habits according to those of their favourite instructors.

Working Diagrams of Valve Amplifying Receiver Circuits. Arranged by H. W. SULLIVAN. Pp. 24; figs. 21. London: H. W. Sullivan. Price 1s. net.

Sullivan instruments have long been noted for their excellence of manufacture and finish. This applies no less to their wireless instruments for experimental work. Mr. H. W. Sullivan has now produced a brochure of working diagrams for use with the component wireless instruments produced by his firm. The booklet contains 21 excellently prepared drawings of single and multi-stage circuits for use as wireless receivers. In each drawing the condensers, inductances, and other component parts are numbered, and will be found in Mr. Sullivan's new catalogue of wireless instruments. Moreover, this enterprising firm provides a standard experimental valve receiver panel with all the necessary component parts fitted, so that by connecting up these parts in different ways nearly all the circuits in the booklet may be tried out, and many other additional circuits not actually given in the brochure. The list of items on the panel includes two variometer condensers, one reaction coupling coil, a series-parallel switch, filament rheostat, grid potentiometer, two iron-core valve transformers, two grid leaks, and two anode resistances, three valve holders, one radio-frequency inter-valve transformer, one variable tapping switch, blocking condensers, and other useful parts. Such a panel is ideal for experimental work and for use in schools, technical colleges, and other places where they teach and learn. Why no firm has previously had the push and go to place such an extremely useful arrangement on the market is almost beyond comprehension. Perhaps experimentalists have preferred "made-up" radio sets. There is no doubt that some wireless experimenters have no greater ambition than to turn the handles of a completed set, and simply listen to signals. Such men contribute nothing to the art and learn practically nothing themselves. Only by trying out innumerable circuits can they hope to gain the necessary experience in their subject. The man who buys a ready-made wireless set is no more entitled to be called an

experimenter than a barrel-organ grinder—also a handle-turner—is deserving of being called a composer. Anything which will encourage the experimentalist to learn the ins and outs of valve work is doing splendid service. There is absolutely no reason why inventions in radio-telegraphy and telephony should all be produced by a clique of professional men. Given a panel of instruments which can be connected in an infinite variety of ways, any experimentalist is capable of doing valuable work. Mr. Sullivan's combination of instruments is ideal for the purpose. Some experimental men, including some of the professional class, seem to prefer to use old coils and scrap pieces of roughly-made apparatus. Although such apparatus can be effectively used in skilled hands, yet time is always wasted, instruments are frequently damaged, and wrong or misleading results obtained. With a well-made set of component parts, the best results may be relied upon.

The diagrams in the brochure are beyond reproach from a technical point of view, and are essentially practical. They cover ordinary valve detector circuits, retroactive circuits, C.W. receivers, valve circuits using a crystal as detector, two-stage receivers, resistance amplifiers, and representative circuits employing up to three valves.

The booklet as a whole is a very commendable one, and reflects credit on its compiler. It is a praiseworthy attempt to make the "experimenter" experiment.—JOHN SCOTT-TAGGART.

Electric Lighting for Cycles and Motor Cycles. By HAROLD H. U. CROSS. Pp. viii+124; figs. 50. London: E. and F. N. Spon, Ltd. Price 3s. 6d. net.

As the Cycle and Motor Show lately held at Olympia revealed, there can be no question as to the increasing popularity of electric lighting both for pedal and motor cycles, so that this new work—the author of which, Mr. Harold H. U. Cross, is well known in connection with handbooks of this kind—should enjoy a wide popularity. In accordance with its sub-title, "A Simply-written Handbook on the Construction, Maintenance, and Repair of Dry Batteries, Accumulators, and Dynamo Outfits," the little volume is couched in language which should be easily understood by the veriest novice in electrical matters, a series of 50 well-chosen illustrations assisting the reader to grasp the meaning of the text.

In the first chapter the author sets out the essential electrical facts in everyday terms, and once these are mastered by riders the remainder of the book should be easily assimilated. Thus the subsequent chapters deal with dry batteries, accumulators, and small dynamos, a number of the principal lighting outfits on the market being afterwards described. Briefly, it may be stated that the possession of a copy of the new work should enable the cyclist or motor cyclist whose machine is fitted with an electric lighting set to keep it in good working condition with a minimum of trouble, and enable him quickly to locate and remedy any small defects which may develop. The book should also prove useful to cycle and motor cycle traders who in their repair departments are likely to be called upon to carry out work in connection with such installations and fittings.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEXTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

36,321. "Measured service telephone systems." Automatic Telephone Manufacturing Co., C. Gillings, and R. Mercer. December 29th.

36,331. "Apparatus for testing magnetos." W. J. Hannah. December 29th.

36,357. "Safety device for electric incandescent lamps." K. A. Beckert. December 29th.

36,407. "Electro-magnetic mechanism." Automatic Telephone Manufacturing Co. December 29th. (U.S., September 7th.)

36,416. "Step-by-step electrical motors." A. P. Addison and H. G. A. Scott. December 29th.

36,432. "Electric cut-outs." P. H. Coales, C. C. Garrard, and A. H. Railing. December 30th.

36,441. "Sparking plug testers." H. L. Curzons. December 30th.

36,443. "Electric flash signs, &c." J. Sawle. December 30th.

36,448. "Jointing armoured electric cables." R. W. Blades and British Insulated & Helsby Cables, Ltd. December 30th.

36,449. "Electric furnace." R. R. Reed. December 30th. (U.S., March 27th.)

36,450. "Microphones." J. Gardner. December 30th.

36,474. "Electric, &c., switches." A. C. Day. December 30th. (Australia, January 15th.)

36,482. "Accumulator cells." A. H. R. Sharratt. December 30th.

36,488. "Protective device for direct-current electric motors." C. E. Fairburn. December 30th.

36,492. "Electric exploders." E. Cudney. December 30th.

36,499. "Dynamo-electric machinery." W. B. Sayers. December 30th.

36,503. "Apparatus for testing electrical machinery." Allmanna Svenska Elektriska Aktiebolaget and A. Yetterberg. December 30th.

36,505-6. "Electric fuses." Metropolitan-Vickers Electrical Co. December 30th. (U.S., January 12th.)

36,522. "Automatic cut-outs for electrically-heated appliances for boiling liquids, &c." E. W. Johnson. December 30th.

36,528. "Electric furnaces." A. Eimer. December 30th. (U.S., July 18th, 1914.)

36,540. "Windings for alternate-current dynamo-electric machines." F. Creedy. December 30th.

36,599. "Manufacture of electric cables." Callender's Cable & Construction Co. December 31st.

36,622. "Sparking plugs." S. Fisher. December 31st.

36,624. "Methods of protecting electric transmission or distribution systems." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. December 31st.

36,626. "Current-collecting devices for dynamo-electric machines, &c." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. December 31st.

36,630. "Radio-transmitting apparatus." Western Electric Co. December 31st. (U.S., December 31st, 1919.)

36,653. "Means for communicating between vehicles of electrically driven trains." J. Bethenod. December 31st. (France, January 3rd.)

36,666. "Electricity cable dividing boxes." South Wales Electrical Power Distribution Co. and A. Wisdom. December 31st.

36,668. "Primary electric batteries." O. Urbasch. December 31st. (Austria, December 28th, 1919.)

36,669. "Sparking plugs for explosion motors." F. E. Le Bissonnais. December 31st. (France, January 5th.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

7,766. "Electrical conductors." Hochstadter. March 27th, 1914. (Convention date not granted.)

1919.

19,316. "Electro-deposited metals." C. P. Madsen. April 26th, 1919. (142,432.)

19,400. "Automatic telephone exchange systems." Western Electric Co. and G. Deakin. May 26th, 1919. (143,830.)

20,790. "Miners' electric safety lamps." Haslam & Stretton and T. Stretton. April 22nd, 1920. (154,867.)

21,441. "Wire-making machines." British Thomson-Houston Co. (General Electric Co.) September 1st, 1919. (154,977.)

21,449. "Method and apparatus for electric signalling through water, for example, between or with ships thereon." Q. C. A. Craufurd and L. O. Doughty-Wylie. September 1st, 1919. (154,978.)

21,594. "Valves used for wireless transmission." H. J. Round. September 3rd, 1919. (154,982.)

21,656. "Electric welding apparatus." British Thomson-Houston Co. (General Electric Co.) September 3rd, 1919. (154,985.)

21,685. "Electric control mechanisms." C. Weismann. August 10th, 1917. (132,265.)

22,074. "Cooling devices for electric transformers and the like apparatus." British Thomson-Houston Co. (General Electric Co.). September 8th, 1919. (155,017.)

22,798. "High-speed electric or other locomotives." British Thomson-Houston Co. and F. W. Carter. September 16th, 1919. (Addition to 128,106.) (155,038.)

23,149. "Sparking plugs." T. B. Broad. September 19th, 1919. (155,049.)

23,752. "High-frequency alternators." British Thomson-Houston Co. (General Electric Co.). September 26th, 1919. (155,061.)

24,718. "Galvanic batteries." O. Oldham, G. Oldham and J. Oldham. October 9th, 1919. (Cognate application 6,654/20.) (155,071.)

25,630. "Sparking plugs." H. S. Cooke. October 20th, 1919. (155,078.)

26,802. "Coin-freed pre-payment devices for telephone systems." Automatic Telephone Manufacturing Co. (Automatic Electric Co.). October 31st, 1919. (155,088.)

27,858. "Generation, transmission, and distribution of electricity." H. Hawkins, W. H. Hanstock, A. H. Higgs, and Ferranti, Ltd. November 11th, 1919. (155,095.)

28,534. "Sparking plugs." J. P. Reijnhout. November 18th, 1919. (155,100.)

32,791. "Electrolytic cells." I. H. Levin. December 31st, 1919. (155,118.)

1920.

190. "Indicators or annunciators." Sterling Telephone & Electric Co. and F. G. Bell. January 2nd, 1920. (155,123.)

2,815. "Electric starting devices for internal-combustion engines." O. Imray (R. Bosch Akt.-Ges.). January 29th, 1920. (155,136.)

4,377. "Portable electric lamps." Compagnie Generale d'Electricite. May 27th, 1916. (138,929.)

4,863. "Insulating protectors for the ends of electric conductors." J. B. Hamilton. February 17th, 1920. (155,148.)

4,878. "Cross arms for supporting electric insulators." F. M. Simpson. February 17th, 1920. (155,149.)

6,359. "Electric couplings." H. A. Douglas. March 2nd, 1920. (155,155.)

11,935. "Electric switches." G. Gallo and F. Villarboito. April 29th, 1919. (142,494.)

17,962. "Cut-out switch for electric polyphase alternating current circuits." V. Martinetto. October 15th, 1915. (145,690.)

A Safe Method of Synchronising.—To prevent mistakes when connecting a three-phase generator to another generator or system with which the first generator is to be synchronised a triple-pole, double-throw switch has been used by a correspondent of the *Electrical World* in conjunction with an induction motor for indicating direction of rotation. The switch is placed near the ends of the two lines which it is desired to connect together, and jumpers are run from the lines to the three blades of the switch. The induction motor is connected to the inside terminals of the switch. The switch is first thrown to the right and the direction of rotation of the motor is noted, and then it is thrown to the left. If the direction of rotation is not the same in both cases, two of the conductors of one line are interchanged at an auxiliary switch to make the directions of rotation identical. Then the oil switch at the first generator is opened and the auxiliary switch is closed. After this one phase of the generator line is synchronised with one phase of the line, after which the oil switch may be closed. The advantage of using this plan comes from the fact that the wires running from the double-throw switch to the two lines are left connected after the directions of rotation have been checked, thus preventing any chance of connecting the wrong wires of the two lines together.